. XXXVII. September, 1909 No. 3.

MUNICIPAL ENGINEERING

A MONTHLY MAGAZINE

DEVOTED TO THE IMPROVEMENT OF CITIES

CONCRETE CONSTRUCTION, PAVING, SEWERAGE, WATERWORKS, STREET LIGHTING, PARKS, GARBAGE DISPOSAL, BRIDGES.

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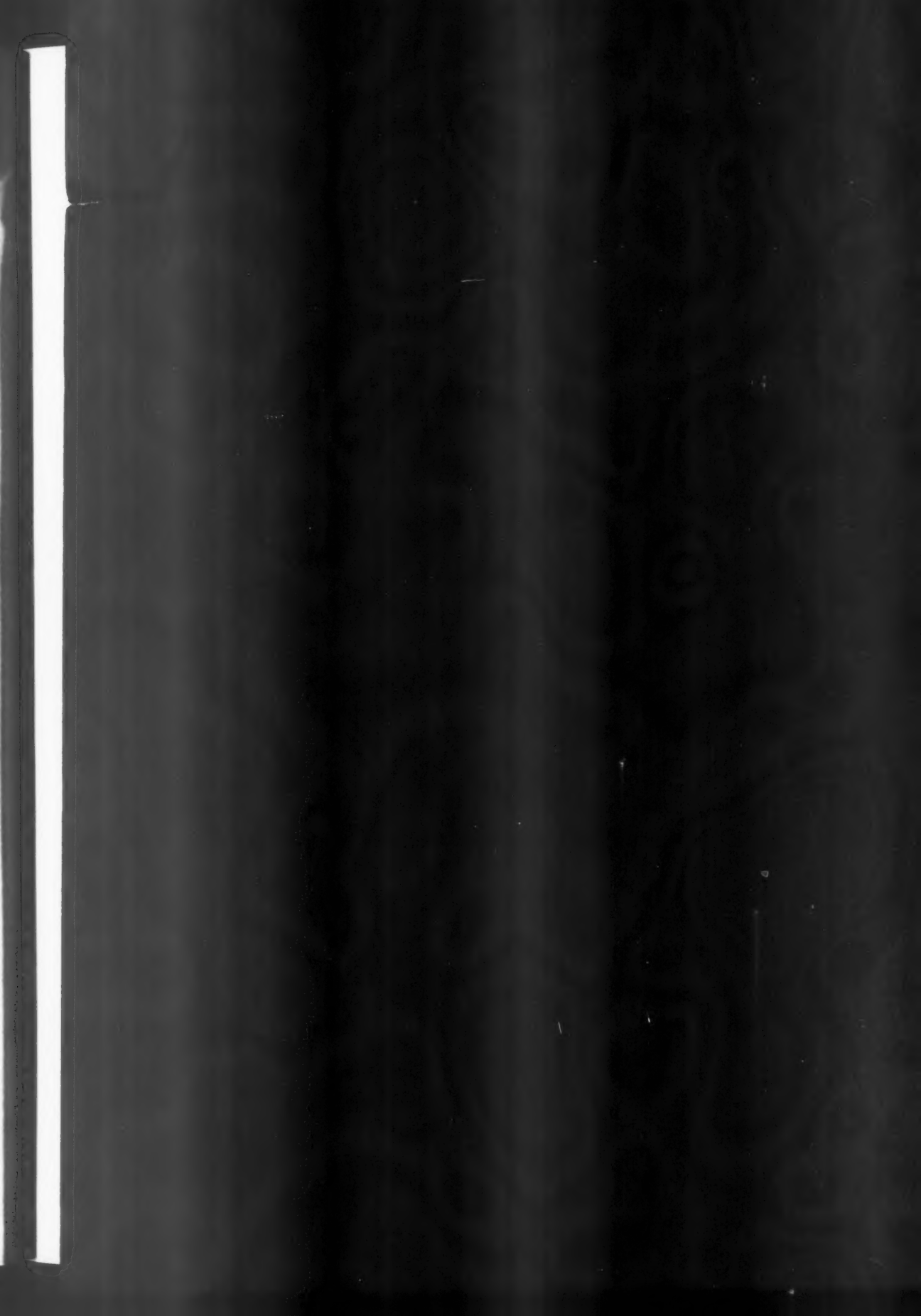

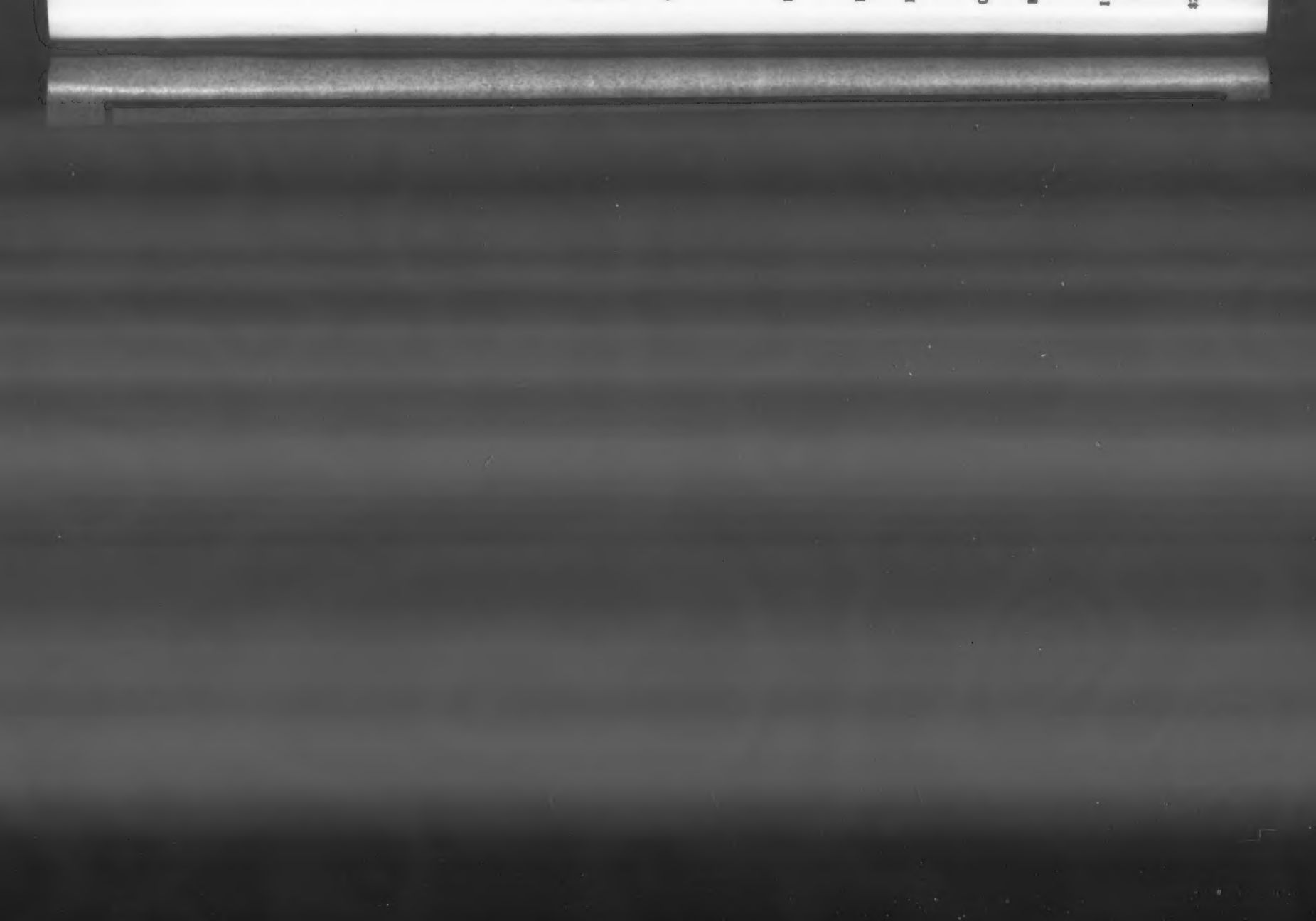

Municipal Engineering

PUBLISHED BY

MUNICIPAL ENGINEERING CO., Indianapolis

NEW YORK OFFICE, 1 BROADWAY

Entered at Post Office, Indianapolis, Ind., as Second-Class Matter.

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MUNICIPAL ENGINEERING

VOLUME XXXVII. SEPTEMBER, NINETEEN HUNDRED NINE. NUMBER THREE

THE COST OF ADAPTING MACADAM ROADS TO AUTOMOBILE TRAFFIC.

By Henry Tipper, New York City.

IN THE article on this subject in the August number of MUNICIPAL ENGINEERING, mention was made of the cost of resurfacing macadam road, using asphaltic binder for the purpose of making the road dustless and able to withstand automobile traffic. The operations mentioned as necessary on this road, in order to put it in shape, were: Cleaning the road, scarifying it to a depth of 2 inches, bringing it to grade with new ¾-inch stone added, rolling, heating, spreading and brooming the macadam binder, spreading screenings and rolling.

It is apparent that the cost as to labor and material will vary considerably between one part of the country and another and the most that can be done in the way of indicating cost in an article of this kind is to give a general resume, from experience, of the average cost of these items, indicating as much as possible the labor required and equipment, so that further compilations can be made, according to local conditions.

The cost of cleaning varies so widely as between one road and another, that it is almost impossible to state any average cost which would be of value. The cleaning is not required, anyway, under all conditions, particularly where considerable scarifying has to be done and new metal added to bring the road to grade. It is, therefore, not included in these costs.

The cost of scarifying depends largely upon the condition of the road. If very little of the surface is to be cut up, the cost of scarifying will be proportionately less. From a number of reports derived from actual costs in several States, the average cost of scarifying such a road would be from six mills to 10 mills per square yard, according to the amount of scarifying required.

The hauling and placing of new ¾-inch stone on the road, allowing the price of the stone at about $2.00 per cubic yard, compiled in the same manner from the writer's own costs and from costs developed by other engineers in different States, the hauling to be not over one mile overage, would be from 6 to 11 cents per square yard, according to the amount of stone required to bring the road up to grade. The rolling and reshaping of the road would be, approximately, five to eight mills.

These costs have not been detailed, as they are so continually being met with in road work that every contractor has a complete record of his average cost on this work and is thoroughly familiar with the proposition.

In the surfacing with binder, outside of the hauling of the material, the operations necessary are: Heating the binder, spreading it, brooming in where necessary, distributing screenings and rolling.

The equipment for this work consists of a heating kettle, equipped with hose and nozzle, or hand dippers and pourers, in case the material is delivered in barrels. If the material is delivered in tank cars, the equipment required will be, approximately, 15 h.p. vertical boiler for heating and drawing from the tank car and a 500-gallon sprinkling wagon.

The question of equipment has not yet been worked out and the costs, so far, are purely experimental on this account, the cost varying a good deal

with the equipment used. For instance, the cost of spreading macadam binder by hand dippers and pourers from a kettle is very much greater than than the cost of spreading it with hose and nozzle. If the amount of work is much, the cost is reduced by spreading it from tank to car with a sprinkling wagon. From records of work done in this way in several states, the labor required for spreading would be, approximately, as follows, some variation in this amount being necessary, according to local conditions. These labor estimates are taken from several different sources and should be considered only this far.

Tank Car and Sprinkling Wagon.—One man firing steam boiler at the tank car, one man handling pump, one man driving sprinkling wagon, one man regulating flow from the sprinkler. The capacity of this method, figuring on two wagon loads a day, with a gallon and a half to the square yard, would amount to, approximately, 660 square yards per day of sprinkling.

With the small kettle and nozzle and hose equipment, the labor required has shown to be, approximately, up to the present two men for each kettle, and it has been estimated that the capacity of this is, approximately, 600 square yards per day. The capacity of this equipment and the labor required in this case depends somewhat upon the character of the material used and also upon the conditions under which the work is done, so that no very definite statement can be made.

It is usual to employ, for the purpose of brooming the binder into the road, from four to six men, according to the width of the road and the character of the surface. In some cases it is not necessary to use so large a gang, if the oil penetrates the surface readily and there are no depressions which will form pools. Four men can be used in spreading the stone and the road afterward need be rolled only once. The average cost of this treatment, as shown by the experience of a number of States, figuring the binder one and a half gallons to the square yard, and the binder cost at from 13 to 18 cents, would amount to from 16 to 21 cents per square yard. This would make the total cost of the resurfacing from 23 to 35 cents per square yard of macadam laid. On a 14-foot road, this would mean an expenditure of approximately $1,800 to $2,500 per mile.

A great deal more investigation is necessary to supply an adequate statement of costs, so that these costs can be properly sectionalized, but this cannot be done until the equipment is more thoroughly decided upon and the actual method of construction which is proved to be best has been generally adopted.

The penetration method is not altogether used for the purpose of resurfacing macadam roads and, in some cases, notably in the work done by Prof. A. H. Blanchard, of Rhode Island, whose roads are cited as examples of what excellent construction can effect, are made by the mixing method. Even less is known of the cost of the mixing method, however, than of the cost of the penetration method, as applied to the resurfacing of macadam roads, and until more information is available such costs as might be given would be only misleading, rather than informing.

The whole situation at the present time, regarding costs, is unsatisfactory until further experience has brought them into better accord.

The cost of construction of new macadam roads with the penetration method of bituminizing the surface is not very much more than the cost of the water-bound macadam road. In this case the surface of the road is spread with binder after the laying of the top course of ¾-inch stone and before the use of any small binder stone. The method adopted and the amount of labor required are the same as stated for the resurfacing, except that there is no scarifying, shaping, etc., necessary to be done. The cost of the road before applying the binder is not equal to the cost of the water-bound macadam road, inasmuch as the continued introduction of the small screenings and stone by wetting down and rolling, which is a somewhat long and expensive process, is not necessary.

Various published cost statements made at different times by different engineers and contractors place the cost of spreading, wetting down and rolling the binder for ordinary macadam road at from 10 to 15 cents per square yard.

The costs mentioned before of .16 to 21 cents per square yard for the heating, spreading and finishing of the bituminous surface, do not represent, therefore, the additional cost over the cost of the ordinary macadam. If the cost of the bituminous surface is 21 cents, a deduction of from 7 to 10 cents must be made from this cost, in order to represent the actual amount which a bituminized surface to a macadam road, according to the penetration method, will cost.

The statement is very often made that a road constructed by the penetration method, with an asphalt binder, will cost from 25 to 30 cents per square yard above the cost of the macadam road. This, however, is misleading, as the cost of rolling and sprinkling, which must be undertaken in finishing the water-bound macadam road, can be largely deducted, except a very small proportion of the rolling cost, which is still necessary in the case of the bituminous macadam.

The State of Rhode Island, in the work of which Prof. Blanchard has charge, has done a great deal of pioneer work in this direction and at a cost which is remarkable from its economical showing. It is to be hoped that more work will be done in this direction, as the results from it are gratifying. As far as the present knowledge of the efficiency of bituminized macadam goes, the mixing method would seem to produce a better character of road than the penetration method with its possibilities of the chilling of the material before it reaches the stone, the impossibility of maintaining dry stone in a road and the consequent care which must be exercised in order to secure the full penetration required to produce a surface bound for a sufficient depth with the elastic binder.

The tendency of prominent engineers and road builders in charge of the improvement of roads for different States in the East appears to be toward the use of some efficient mixing method which will provide a 3 or 4-inch surface of bituminous macadam where the mixture can be made with binder and cold stone, providing the cost can be kept down to reasonable proportions.

THE NEW PITTSBURG FILTERS.

By Hartley M. Phelps, Pittsburg, Pa.

THE largest individual sand filtering plant in the United States for supplying a city with pure water is now practically completed at Pittsburg. It is a most remarkable and interesting piece of work with its fifty-six concrete filters covering one acre each, its unique sand-scraping and sand-restoring machines and its devices for operation and measurement—all of which have focussed on it the attention of engineers the country over. The cost of this great work has exceeded six million dollars, but the tax-payers believe it to be money well spent, as the death-rate from typhoid fever has been cut in half since the filtered water was turned into the mains. And this is saying much, for Pittsburg formerly bore the unenviable distinction of having the highest mortality rate from this source in the land, according to statistics compiled by the Federal Government.

Aside from its construction and engineering features the plant is unique inasmuch as it is built with a careful regard for the aesthetic. The top has been laid out into a beautiful park embracing 110 acres, with drives, winding walks, ornamental bridges and shrubbery, an original scheme made possible by the fact that a modern filtration plant is nearly all underground.

Ten of the fifty-six filters were recently added to the plant to supply the old city of Allegheny, which has been annexed to Pittsburg. The original forty-six filters have a net capacity of 105 million gallons of water, each filter putting forth three million gallons every 24 hours, allowing for beds temporarily out of commission while being cleaned. This 105 million gallons also represents the aggregate capacity of the three sedimentation basins, the central one of which is called the receiving reservoir. In this connection it may not be amiss to note that the immense filtration plant in Philadelphia is larger in toto than the one at Pittsburg, but it comprises four distinct divisions, whereas the Pittsburg works forms one solid whole.

The latter is located on the north bank of the Allegheny river, seven miles from its junction with the Ohio and opposite the city line on the south. It covers a large flat area extending from the river shore to a line of hills about one-half mile inland and is intersected, east and west, by the Western Pennsylvania branch of the Pennsylvania Railroad.

The intake consists essentially of a concrete chamber 69 feet 7 inches by 33 feet 9 inches, with a height of 49 feet, divided transversely into two sections, which are operated separately. The raw river water enters through sixteen 4-foot circular, concrete conduits in a sloping wall of concrete along the river bank, Plate I, and passes into two chambers 12 by 28 feet back of the revetment. These circular openings are in two rows of eight each, one being below low-water line so that the river water can be drawn from whatever level is most desirable during flood-stage or other time. The conduit basins are controlled by sluice-gates operated manually through ball-bearing stands on top of the intake. Stop planks also cut off the flow. Mud and debris are flushed out of the sixteen conduits by means of a 30-inch pressure main leading from the pumping station and connecting with a conduit built longitudinally in the outer wall of the receiving chamber. This conduit connects with each inlet conduit in the lower row of the intake openings so that by closing the sluice-gate and placing the stop planks the intake conduits may be cleaned.

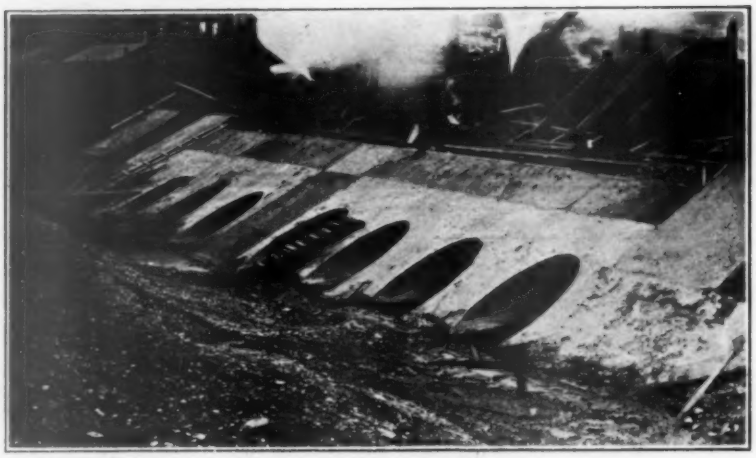
The outlet from each receiving chamber is a 6-foot by 9-foot channel, these merging into a single great conduit 124 inches in diameter, constructed of concrete and leading to the pumping station. In each of these chambers is a sluice-gate. About 230 feet from the intake chamber this giant conduit divides into two 100-inch ones, one leading to the station and the other intended to supply an additional station not yet built. For the present this latter conduit is bulk-headed. The Ross pumping station (which is the one alluded to) is one of the finest of its kind in the country, both in point of equipment and as regards the building itself and its design. Here are installed four 36-inch centrifugal pumps, equipped with vertical, cross-compound, Corliss engines, these pumps sending the water through the great 96-inch steel rising main to the receiving basin adjacent to the hill a quarter of a mile away. Each pump has a daily capacity of 35 million gallons with a possible overload at short intervals. There are also three d'Auria pumping engines with a combined capacity of 13 million gallons a day and a battery of eight Aultman and Taylor water-tube boilers of 300 h. p. each. The pump pit is 28 feet wide and lies 16 feet below the general floor level.

Every modern device and facility in pump house equipment is to be seen in this fine, commodious building. The coal is hoisted out automatically and fed to the boiler-fires by the turn of a lever; chain-grate stokers insure an even, steady supply of fuel; the ashes are removed automatically and carried away by a little compressed-air locomotive. There are pumps to pump the water with which the sand in the filters is washed; electric motors to operate the machinery in the grate-chambers at the basins, and generators for supplying electric light for the plant and grounds. Near the pumping station rises a brick stack 200 feet high, having an internal diameter of 8 feet, which carries off the gases from the station.

Architecturally the pump house is among the most beautiful in the country. With its exterior of buff brick; main entrance embellished with ornamental columns; with an adornment of sculptures in bas-relief and handsome window casements and sky-lights and its imposing array of machinery shining like burnished gold and silver, it looks more like an exhibition room than the working quarters of a great municipal utility. The glass in the roof is corrugated to conform with the tile, a feature that is not to be found in any other pumping station in the United States. By much skill in landscape gardening, the handsome building has been given an appropriate setting against broad walks, drives, shrubbery and flowers. Visitors are always welcomed and shown the points of interest on the premises.

At the receiving basin in the basement of the administration building, is a great gate chamber 50 by 53 feet, of concrete, carried on two hundred concrete piers, the flow from the 96-inch steel rising main being controlled by an electrically-operated gate-valve and a check valve in the valve chamber outside the gate house. A giant Venturi meter with a 50-inch throat, the largest of its type ever built, measures the water at this point, with a discrepancy that will not exceed from 100,000 to 500,000 gallons in every one hundred million. The administration building is three stories high and contains the office of Superintendent Morris Knowles, his assistants and the chemical and bacteriological laboratories, where daily tests of the filtered water are made.

The three sedimentation basins cover 27 acres and are 19 feet in depth, the receiving reservoir having a capacity of 20 million gallons and the basins



I. PITTSBURG FILTER PLANT.
Intake Conduits.

II. PITTSBURG FILTER PLANT.
Showing Method of Filling Receiving Basin Without Developing Currents.

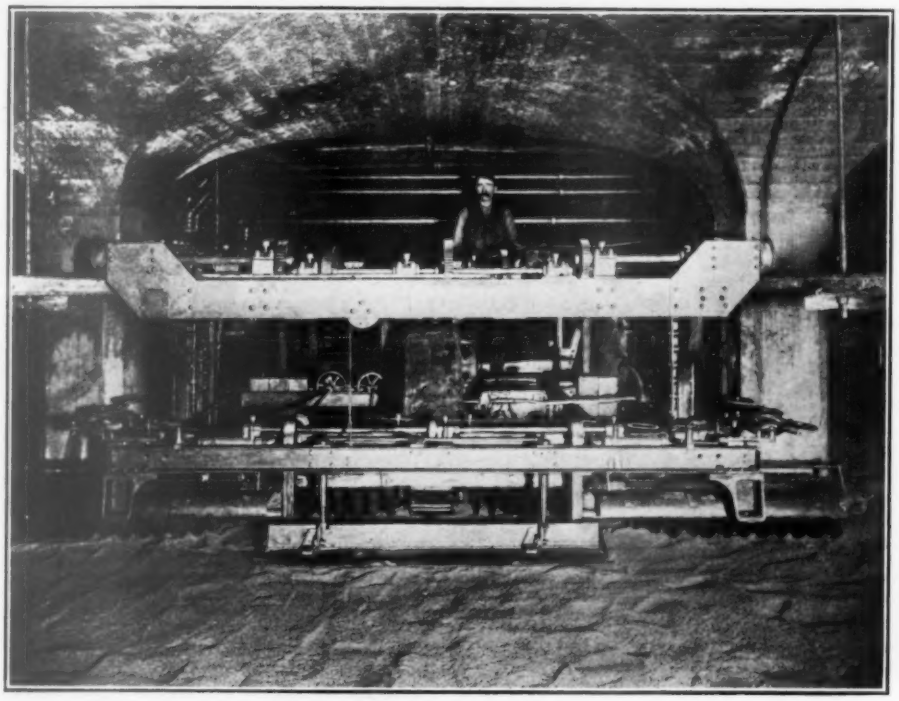
on either side 65 millions, or 150 millions all told. This is also the capacity of the pumps per day, but an overload of quite an added percentage is possible. The bottom of the basins is lined with six inches of 1:2:4 concrete laid directly on the clay bottom, which was rolled compactly with traction engines. The inlet conduit of the receiving basin is formed by the merging of two 6 by 9-foot conduits which lead from the gate chamber, making a concrete passageway 9 by 12 feet wide at the inlet end and tapering down to 4 by 4 feet at the outlet. Bell-mouthed holes 18 inches in diameter in the top of this conduit let the water out, as shown during process of filling in Plate II, the arrangement being such that when the basin is full no current is created by the overflow, thus facilitating the settling process. Four-fifths of the mud and other solid matter in the water is left in the basin, the settling process being completed in the sedimentation basins. For further helping along this purification the inlets and outlets are so placed that the water must traverse the entire length of the basins. The bottom of the receiving basin has a fall to the drainage openings so the work of cleansing the basin is made easier.

The vast filters form one of the most interesting parts of the filtration plant. They are built entirely of concrete with inverted, groined-arch floors of two layers of four inches each; and with groined-arch covers supported by piers, as shown in Plate III. Between each row of filters is a gallery 1,000 feet long in which the pipes, wires and regulating and registering apparatus relating to the filters are carried, each gallery comprising three continuous bays, the inside one being 14½ feet in height. This latter contains a mezzanine floor from which the operation of the filters can be effected and under it, set on concrete pedestals, is the settled-water supply main of riveted steel, varying in diameter from 60 to 30 inches, conveying water from the sedimentation basins to the filters, the flow entering the latter through a 20-inch pipe. Each filter has a sluice-door 5 feet 3 inches by 7 feet, operated by hydraulic cylinders, by which means ingress is afforded and the big sand-washing and sand-restoring machines are run in.

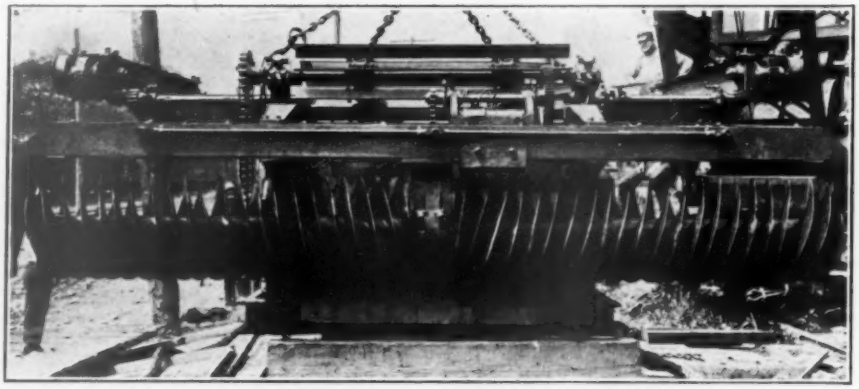
The filter-beds consist of a one-foot layer of four sizes of gravel, placed so the finest gravel rests on top, and a four-foot layer of sand of stipulated fineness. The sand effects the filtering of the water and the gravel acts as an underdrain, the water passing into a large central collector in the middle of the filter. Entrance to the galleries (and therefore to the filters) is through manholes by means of spiral staircases or of a door at the south end of the gallery where the latter comes out flush with a depressed roadway running through the grounds. Large circular skylights illuminate the galleries and huge fans keep the air pure, while a heating system will maintain the equable temperature of 50 degrees F. during the coldest winter days.

One of the many interesting pieces of mechanism of the plant is the "patrol box" in front of each filter, from which samples of water are tapped for analysis. As the key turns the lock of the box it registers automatically in the superintendent's office the time of drawing the water, thus preventing the interpolation of records. This, of course, is a very important thing. In front of each filter is a recording gauge indicating the rate of filtration, loss of head and depth of water over the sand.

The most unique features of the entire plant, however, are the sand-scraping and sand-restoring machines, especially designed for this plant and used for the first time in any filtration works in this country. As is well known to engineers, a sand filter accumulates, after a time, a jelly-like film called "schmutzdecke," made up of the solid impurities filtered out of the water. This lies on the sand and prevents or impedes the purifying process, so, of course, it must be removed. The sand must be washed from time to time and renewed. In ordinary plants this labor is done by hand, which, in the case of a filtration plant for a large city, entails great expense. To do this work, remove the unclean sand and transport it to the washing galleries, is the work of the sandscraper, shown in Plate III. So perfect is the adjustment of this large piece of mechanism that it will take up one-quarter of an inch of the sand layer in the filter. It is carried by a traveling bridge or crane which runs on an overhead track. Two spiral conveyors, 16 inches in diameter, scrape the sand and deliver it to buckets on an inclined elevator, driven by motor, which discharges into the hopper of a hydraulic ejector. This in turn forces the water and sand through a series of pipes to a sand-washer in the gallery. The scraping of the sand is effected by a steel shoe that rests on the ground and lies parallel to the spiral conveyors. One great advantage this machine pos-



III. PITTSBURG FILTER PLANT.
Sand Scraping Machine for Cleaning Filters.



IV. PITTSBURG FILTER PLANT.
Machine for Restoring Sand to Filters After Washing.

sesses is that only one man is required to operate it.

This is also true of the sand-restorer, the unloading of which is shown in Plate IV. It runs on an overhead track the same as the scraper. It spreads the cleaned sand by means of two spiral conveyors, a pipe leading direct from the sand-washer to the machine, the sand being transported by the water, which is expelled by the machine as it spreads the sand. The evenness with which this sand is spread is most remarkable. By using the two machines noted the necessity of having large sand storage houses is done away with, a great amount of space thus being saved. Four hours are consumed in scraping and refilling a filter and the Pittsburg authorities state that fully $25,000 a year will be saved by thus doing away with hand labor. There are twelve sand scrapers and six restorers all operated by electricity supplied from wires on the roof of the filters.

After the filtering is complete the water enters a large reinforced concrete conduit, Plate V, which leads to the filtered-water reservoir on the bank of the river. This reservoir covers between five and six acres and has a capacity of 45 million gallons. It is 1,194 feet long and of irregular shape on account of the railroad passing near the river, one end being 294 feet and the other 168. The side next the river contains a revetment of 7 by 7-foot blocks of concrete one foot thick. The interior of the basin is 26½ feet in height, the roof being supported by pillars of concrete 21 feet high supporting arches. Before the water was turned in, this interior resembled that of a vast cathedral or abbey cloister. There is no light admitted except through a hatch which is only opened to allow of putting in a small row boat. Air is admitted through a house built over the outlet at the gate chamber. Here also are sluice-gates where the water is controlled as it passes into the huge, six-foot mains that carry it across the river to the pumping station at Brillant on the southern shore.

The laying of these two mains on the bed of the river was an enormous task and formed the most difficult and dangerous part of the contractor's work. It involved the building of three great coffer dams, one in the middle of the rapidly-flowing Allegheny. Springs below the river-bed filled the ground between the dams so rapidly that pumps with a combined capacity of 35 million gallons a day had to be kept working constantly while floods and ice-floes wrought havoc, at one time destroying an entire dam. The steel mains were laid in concrete, which acts as a submerged dam, and were then covered with earth, also being strengthened by reinforced steel sheet piling on the upstream side. Rows of piles were driven on the downstream side and tied with timbers to prevent the scouring out of the river bottom below the concrete. Plate VI shows the work in progress. Upon reaching the Brillant station the water is lifted two hundred feet to the Highland reservoirs directly above, and from there flows through the distributing mains of the city by the usual force of gravity.

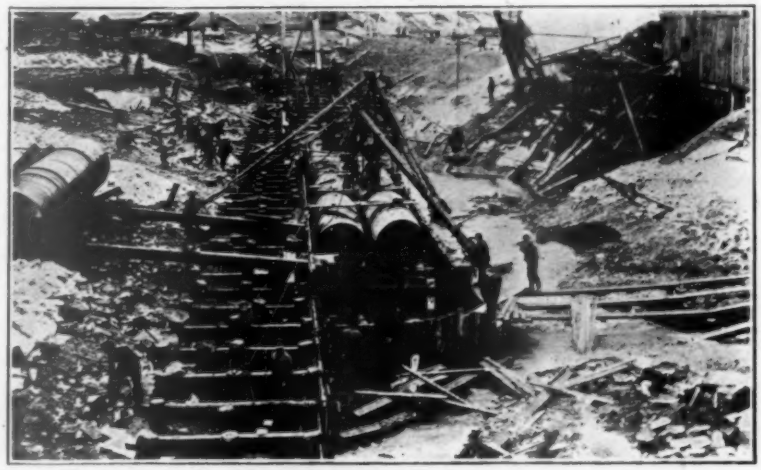
A gigantic piece of pipe-laying was carried on from the Brillant station across the central part of Pittsburg to the south side of the city, across the Monongahela river, seven miles of 50-inch steel pipe being laid. The stretch under the river mentioned is of 36-inch pipe. More than two miles or 11,000 lineal feet of metal pipe were laid in and around the filtration plant itself.

The largest single items in the contract for the plant were the excavating and the concrete laying. Excavations had to be made for all basins, reservoirs, filters, drains, pipe lines and foundations of gate chambers and buildings. In all 850,000 cu. yds. were taken out, 268,000 cu. yds. of concrete were laid and 117,000 lbs. of reinforced steel were used.

The plant of the contractors, the T. A. Gillespie Co., of New York and Pittsburg, for the carrying on of this vast work involved an investment of several hundred thousand dollars. The largest concrete-mixing plant in the work was installed, this with auxiliary plants having a combined capacity of 2,000 cu. yds. of concrete a day of ten hours. The sand and gravel for the concrete were taken from the Allegheny river, a huge dock being erected on the bank and clam-shell derricks lifting the material out of boats where it had been deposited by dredges. From this dock a tramway of the overhead kind, 1,000 feet long, carried sand, gravel, cement, etc., to the bins at the various concrete-mixing plants. The two storage houses for the cement held 25,000 barrels. Sand-washing and sand-grading machines were placed on the grounds.

For the grading and excavating four steam shovels of a combined capacity of 4,000 cu. yds. a day; two steam graders, capacity of 2,000 cu. yds. daily, besides one hundred teams and dump

V. PITTSBURG FILTER PLANT.
Reinforced Concrete Filtered Water Conduit.



VI. PITTSBURG FILTER PLANT.
Laying Mains Across River.

wagons and wheeled scrapers were used. Twelve dinkey locomotives and several miles of track were utilized.

The vast amount of concrete work necessitated the erection of a sawmill and the employment of 140 carpenters to make the lumber forms for the concrete, some of which were very intricate and demanded the services of skilled men, familiar with reading involved specifications and plans.

COST OF PAVEMENTS.

THE committee on roads and pavements of the Illinois Society of Engineers and Surveyors presented to the last convention a tabular statement of the cost of laying pavements in a considerable number of cities in sufficient detail to make comparisons of some value. The detail, however, is regarding the materials and methods of construction and does not take into account the differences in the methods of paying for work, the discounts on bonds, the interest on deferred payments and other expenses which vary considerably in different states, and somewhat in different cities in the same state. However, contractors say that it is almost as difficult to get work paid for in one state as another and so they make but little difference in their bids. This statement must be taken cautiously, for there are not many paving contractors, except those having proprietary processes or materials, who extend their operations beyond the boundaries of one state.

The following figures are taken from the tables referred to and are rearranged and condensed so as to bring together the examples as nearly as may be according to a classification of the details which make the most difference in cost of pavements. The examples from each state are grouped together and the limits of the variations in each state are given, and any other probable reasons for peculiarity in prices are added.

BRICK PAVEMENTS.

The prices for brick pavements are arranged in the order of the depth of foundation, which is usually of concrete, there being but few other kinds of foundations noted.

Buffalo, N. Y., has a brick pavement on an old 12-inch macadam pavement which cost $3.06 a square yard, with 1-inch sand cushion and cement filler.

Chicago, Ill., has a pavement on 10-inch slag foundation which cost $2.25, with 2-inch sand cushion and tar filler. Akron, O., has them on 10-inch sand foundation which cost $1.07, with like cushion and filler.

Illinois pavements on 8-inch concrete foundation, sand filler, cost $1.70 to $1.95; on broken stone foundation, tar filler, they cost $2.10. Ohio pavements on 8-inch gravel foundation cost $0.99 to $1.12, with sand filler and $1.23 with tar filler; on sand with cement filler $1.79; on old macadam foundation with tar filler, $1.41; and on slag with tar filler, $1.13. West Virginia pavements on 8-inch gravel foundation, sand filler, cost $0.98 to $1.14, practically the same as Ohio pavements on same specification. An Indiana pavement on old macadam with cement filler cost $1.30. A Troy, N. Y., pavement on old relaid granite blocks cost $2.30, including the relaying.

Kentucky pavements on 6½-inch concrete foundation with cement filler cost $1.82 to $1.85.

Connecticut pavements on 6-inch concrete foundation, with cement filler, cost $2.79. Georgia pavement, with tar filler, cost $2.08. Illinois pavements on 6-inch concrete foundation, with sand filler, cost $1.40 to $1.94; with tar and cement fillers $2.55 (Chicago price); with asphalt filler $1.55 to $1.73; and with cement filler $1.40 to $2.55, the latter being the Chicago price; on slag foundation, tar filler, the Chicago price is $2.05. Indiana pavements on 6-inch concrete, asphalt filler, cost $1.32 to $1.44, and with cement filler, $1.34 to $2.00, the latter being the Indianapolis price; on broken stone foundation with sand filler the cost is $1.30. Michigan pavements on 6-inch concrete, asphalt filler, cost $1.90 to $1.94; with cement filler $1.80. New York pavements with cement filler cost $1.61 to $2.60, the latter being the Buffalo price. Ohio pavements cost $1.30 to $1.60, with sand filler; $1.80 to $2.15 with asphalt filler and $1.39 to $2.45 with cement filler, the latter being the Cleveland price. Pennsylvania pavements with cement filler cost $1.97 to $2.17. Wisconsin pavements with asphalt filler cost $1.90.

Alabama pavements on 5-inch concrete foundation, sand filler, cost $1.90; Illinois, with asphalt filler, $1.85 to

$2.04, and with cement filler $1.85; Nebraska, with sand filler, $1.97 to $2.18; and Ohio with asphalt filler $1.63 to $2.13.

Arizona pavement on 4-inch concrete foundation, tar filler, cost $2.23; Illinois, asphalt filler, $1.65, and cement filler $1.65 to $1.67; Ohio, asphalt filler, $1.28 to $1.43.

The variation in cost with the thickness of the concrete foundation is indicated by the cost with asphalt and cement fillers in Decatur of $1.65 on 4-inch and $1.85 on 6-inch base; also by the cost in Youngstown, O., with asphalt filler, $1.28 to $1.43 on 4-inch, $2.13 on 5-inch and $2.15 on 6-inch foundation.

There are indications that the cost varies with the kind of filler from sand, the cheapest, though cement and tar to asphalt, the most expensive, but this order does not show clearly except in the Ohio group, which is the most complete.

Sand and gravel foundations produce very cheap pavements and broken stone is appreciably cheaper than concrete of the same thickness.

Much more than half the reports are from Ohio, Indiana and Illinois, in which states the use of brick pavements is more general than elsewhere, so that the proportion of reports from those states is not excessive.

ASPHALT PAVEMENTS.

The reports regarding asphalt streets are arranged in the order of the thickness of the bituminous layers.

A Connecticut pavement 4 inches thick, 2½ inches binder and 1½ inches top, on 6-inch concrete foundation, cost $2.35 a square yard. An Ohio pavement with 1 inch binder and 3 inches top on 6-inch asphaltic concrete base cost $1.98.

Illinois pavements 3 inches thick, 1½ inches stone cushion and 2-inch top on 6-inch concrete foundation, cost $2.15, with bituminous cushion, $2.03, and with 2-inch bituminous binder and 1½-inch top cost $2.10. Indiana pavements with 1½-inch binder and 2-inch top cost $1.80. A Minnesota pavement with 1½-inch gravel cushion and 2-inch top cost $2.80. New Jersey pavements with 1½-inch binder and 2-inch top cost $2.49 to $2.63. A New York pavement with 1½-inch binder and 2-inch top cost $2.76. An Ohio pavement with 1-inch binder and 2½-inch top on 6-inch asphaltic concrete base cost $2.33. A Pennsylvania pavement on asphaltic concrete with 1½-inch binder and 2-inch top cost $2.23.

Connecticut pavements 3 inches thick, 1½ inches binder and 1¾ inches top on 6-inch concrete foundation cost $1.90 to $2.70 per square yard. A similar Washington, D. C., pavement on 6-inch asphaltic concrete base cost $1.68 and a Rhode Island pavement with stone only on the binder coat cost $2.25. An Indiana pavement on 6-inch concrete base, with 1-inch binder and 2-inch top, cost $2.00 a square yard. One in Ohio with 6-inch asphaltic concrete base cost $2.10. Similar Pennsylvania pavements cost $1.19 to $2.60, and on 5-inch asphaltic concrete cost $1.37 to $1.75. An Ohio pavement with stone only in the binder course cost $1.90.

An Arizona pavement 2½ inches thick, 1-inch binder and 1½-inch top on 4-inch concrete foundation cost $2.05. A New Jersey pavement, same, except stone only on the binder course cost $1.64. An Indiana pavement 1-inch stone cushion, 1½-inch top, 5-inch concrete foundation, cost $1.95 and one on 6-inch base cost $1.75.

An Indiana pavement 2 inches thick, 1-inch binder and 1-inch top, on 5-inch concrete foundation, cost $1.55 a square yard.

It may be noted that the states from Ohio east, except Connecticut and New Jersey, use asphaltic concrete for the base, and the other states reported use cement concrete.

Omitting the 4-inch pavement, each reduction in thickness of the bituminous superstructure makes an average difference of about 25 cents a square yard, some of the individual variations from this average being very great, particularly in the cities using 1-inch binder and 2-inch top, where many of the prices are well below the curve of prices from which this average was deduced.

An increase in cost of asphalt pavements with distance from the Atlantic, which is sometimes claimed, does not show in these figures, indeed, there is a tendency toward lower prices as far west as Indiana. The number of states and cities appearing in the table is not sufficient, however, to draw any safe conclusions from, being only 27 cities in 12 states.

BITULITHIC.

There is only one report on bitulithic in the tables, from Birmingham, where it is reported to cost $1.90 a square yard on 6-inch slag foundation, with a bituminous cushion and 2-inch top.

ASPHALT BLOCKS.

Asphalt blocks are reported from 3 cities in Ohio to cost $1.90 to $1.98 a square yard, with 6-inch to 4-inch concrete base, ½-inch cement mortar or 1½-inch sand cushion and sand or

asphalt filler. Washington, D. C., pays for the blocks on 5-inch gravel foundation, with 2-inch sand cushion and sand filler, $1.65 a square yard.

WOODEN BLOCKS.

Creosoted wooden blocks on 6-inch concrete foundation with ½-inch to 2-inch sand cushion and asphalt or tar filler range in price from $2.40 at Indianapolis to $2.60 at Champaign, Ill., $3.02 at Grand Forks, N. D., $3.40 at Bridgeport, Conn., and $3.49 at Chicago ($3.44 with sand filler). Springfield, Mass., pays $3.27 for blocks on 4½-inch concrete foundation with dry cement mortar cushion and cement filler.

SANDSTONE.

Sandstone blocks with 6-inch concrete foundation, 1½ to 2-inch sand cushion, are reported from Duluth to cost $2.40 to $2.70 with sand filler and from Grand Rapids, Mich., $3.85 with cement filler. Cleveland, O., pays $3.06 to $3.08 a square yard for common blocks on 8-inch sand foundation with cement filler, and $3.22 for dressed blocks.

GRANITE.

The cost of granite blocks ranges from $1.65 to $1.73 with 6½-inch concrete base and cement filler at Covington, Ky., to $2.15 with 6-inch gravel base and cement filler at Lawrence, Mass.; $2.27 with 6-inch concrete base and sand filler at E. St. Louis, Ill.; $3.00 with 6-inch concrete base and cement filler at Troy, N. Y.; $3.15 with 5-inch concrete base and sand filler at New Bedford, Mass.; $3.89 with 6-inch concrete base and tar filler at Chicago; $3.98 with 4-inch concrete base and sand filler at Butte, Mont.; and $4.00 with 5-inch concrete base and cement filler at Hartford, Conn.

The variations in these prices show on the surface no reason for their peculiarities.

MACADAM.

The reports on macadam pavements are arranged in the order of the total thickness of the compacted layers of stone at the center. Some specifications provide for 2 to 3 inches less thickness at the sides, but this is neglected in this classification. In each case the stone used is limestone unless otherwise definitely stated. The prices are per square yard. These figures for thickness of layers and sizes of stone are abbreviated; the first group shows the thickness of layer and sizes of stone for the bottom layer; the second group shows the thickness of layer and sizes of stone for the top layer; in only one case is there a third layer other than the binder course, which is required in every case but one and consists of screenings, mixed in Chicago with cinders. In cases where the sum of the thicknesses of the layers exceeds the total thickness of the pavement, the thickness of the layers is given for the loose stone and the total thickness is that of the consolidated pavement.

In Ohio 12½-inch macadam costs $2.25 with 9 inches of 1 to 2½-inch limestone and 3½ inches of 1 to 2-inch trap rock.

Macadam 12 inches thick ranges from 50 cents for granite in Massachusetts; 51 cents for trap in Connecticut, to the following for limestone: Ohio, 56 cents for 8 inches of 2½ to 4-inch and 6 inches of 1 to 2½-inch stone and 80 to 90 cents for 8 inches of ½ to 3-inch and 6 inches of ½ to 2-inch stone; Illinois, 98 cents for 6 inches of 2½ to 4-inch and 6 inches of 1½ to 2½-inch stone; Wisconsin, 8 inches of 1 to 3-inch and 3 inches of 2 to 5-inch limestone and a 4½-inch top of granite screenings. Chicago uses 8 to 11 inches of 6-inch slag and 4 to 3 inches of 1 to 2½-inch limestone and pays 79 cents to $1.20.

Macadam 10 inches thick costs 55 cents in Indiana with 6 inches of 1 to 4-inch and 6 inches of ¼ to 1-inch stone, and 80 cents for 6 inches of 2½ to 4-inch and 4 inches of 2½ and down. The cost in Ohio is 45 cents for 5½ inches of 1½ to 2½-inch stone.

Macadam 9 inches thick costs 55 to 65 cents in Wisconsin for two 6-inch layers consolidated and 58½ cents under a specification of 7 inches of 3 to 4½-inch stone and 5 inches of 1½ to 2-inch stone. In Illinois it costs $1.28 for 6 inches of 4-inch and 3 inches of 1 to 1½-inch stone.

Limestone macadam 8 inches thick costs in Illinois 40 cents for 6 inches of 4 to 6-inch and 5 inches of 1 to 2½-inch stone; Ohio, 56 cents for two layers of 5 inches and 6 inches of ½ to 3-inch stone and $1.09 for 6 inches of 1 to 4-inch and 3 inches of 2-inch stone. Trap rock macadam costs in Massachusetts 75 cents for 7 inches of 2-inch and 1½ inches of 1¼-inch stone and in New Jersey 95 to 98 cents for 5 inches of 2½-inch and 5 inches of 1-inch stone.

Seven-inch limestone macadam in Ohio costs 56 cents for 5 inches of 2½ to 4-inch and 4 inches of 1 to 2½-inch limestone. Trap rock macadam costs 70 cents in Minnesota for 6 to 8 inches of 1-inch and 1½ inches of less than 1-inch stone, and $1.01 in New Jersey for 7 inches of 1¼ to 2-inch and 3 inches of ½ to 1¼-inch stone.

Six-inch limestone macadam costs 34 cents for 4 inches of 3½ to 2½-inch and 3 inches of 1½ to 2½-inch stone in Ohio. Trap rock macadam ranges from 60 to 75 cents in Washington, D. C., for 6 inches of 2-inch and 3 inches of ¾-inch and under and 65 cents for 4 inches of ¾ to 2-inch and 2 inches of 1 to 1½-inch stone to 70 cents in Massachusetts for 5 inches of 2½-inch and 2 inches of 1¼-inch stone, while a mixture of trap and slate of same sizes costs 80 cents.

Five-inch trap macadam in Massachusetts costs 50 cents for 4 inches of 2-inch and 1½ inches of 1¼-inch stone.

All prices are per square yard of finished macadam surface.

An interesting showing in the above is that the thickness of the macadam layers makes comparatively little difference in the cost. There is an appreciable difference in the average cost of 6-inch and 12-inch macadam, although in the same state there are instances of the same cost of streets of the two thicknesses. The figures for trap rock streets show more conformity to the variations in quantity of material, there being a slight tendency to greater increase in cost than in quantity of stone used.

Another interesting observation is the difference in specifications for sizes of stone used and relative thickness of layers. In a few cases there seems to be a desire to fit the sizes and amounts of each group of sizes to the conditions at the stone crusher, but in others the requirements would leave much unused material. This waste of material, and it may be properly so called, seems, on careful study of the figures given, to account for some of the peculiar variations in prices, and in a few instances has apparently increased the cost of certain streets materially.

MUNICIPAL ENGINEERING IN PORTLAND.

By W. P. Hardesty, C. E., Portland, Ore.

PORTLAND is the oldest of the principal cities of the Pacific Northwest. Its growth, until the past three or four years, has been comparatively slow for a western city. In its avoidance of everything but the substantial in its development, the city has generally been regarded as ultra conservative. Beginning in 1905, Portland took on a new life, since which time so rapid has been its growth that the extension of the ordinary municipal utilities has hardly kept pace with the expansion and rapid building up in every direction.

Of the principal utilities required in every municipality, the lighting has always been supplied by a private corporation. The municipality has been more forward than most cities in providing an abundant supply of pure water. The water-works department is managed by a commission, called the Water Board, that employs its own engineer. The city has never had a board of public works. The execution of the ordinary public works is entrusted to the city engineer, appointed by the Mayor. The principal construction works carried out by the City Engineering department are the sewerage systems and street improvements. Prior to the adoption of its present charter on January 23, 1903, all street improvements and sewer works were in charge of a Superintendent of Streets. There was no City Engineer, but here was a City Surveyor whose work was practically limited ot giving lines and grades.

In carrying on his work, the City Engineer has several assistant engineers, designated by ordinance as "Civil Engineers." For improvement work the city is divided into several districts, each in charge of a distrct engineer. Until recently, these district engineers had charge of only the survey work within their respective districts. Within the city engineering department was an inspection service, with several chief inspectors and a number of subordinates. To the inspectors was given the inspection of all contract work, the superintendence of what work was done directly by day labor, and maintenance and repair work. The chief inspectors reported directly to the city engineer, and they were not directed by the district engineers, contrary to the nearly universal custom. Under the practice very recently inaugurated, the head inspectors within the different districts are directed by the district engineers.

In contract work in Portland, as has

always been required by the charter, no partial estimates can be made the contractor, but he must wait until his contract is entirely completed and accepted before receiving any pay. In a large contract taking a long time to complete, especially in high-class construction where final tests and disputes as to quality of work may delay acceptance, this puts a heavy burden on the contractor, and it results in prices for city work averaging 10 to 25 per cent. higher than for work where the usual method is followed.

The Mayor is assisted in his work by an Executive Board, appointed by himself. This Board awards contracts and accepts work, the appropriations for payment being made by the City Council. Working within the board are a number of committees, each dealing with a separate subdivision of the city's affairs. The City Engineer confers with this board regarding his work, having but little direct dealing with the City Council.

The present city charter has been found faulty in some respects. Some small matters that are more properly subjects for ordinance have been included within it. Proposed amendments to it can be voted on at the general municipal election, held every two years. At the election in June, 1909, a proposed new charter on the commission plan failed of adoption.

Under the present charter there is a Mayor, a single body of fifteen councilmen, an auditor, treasurer, attorney, and a municipal judge, all elective. The Mayor has power of appointment of other officers, without consent of the council.

The auditor's office is one of the most important in the city government. In it are included the duties of city clerk and recorder, offices commonly found in other city governments, and all assessments against property for public improvements are figured here instead of in the city engineer's department.

The direct assessment method of paying for public improvements in Portland is carried further than is usual. Grading, sidewalk and pavement improvement of street, sewer laterals, and for the past two years all water mains in size less than 10 inches, are assessed directly against the abutting property. Each lot is assessed its share for the half street width directly in front of it. This rule proved very inequitable in cases where, in grading, heavy cuts or fills fell in front of certain lots, as the yardage of material was segregated for each lot. To remedy this to some extent, it is now the practice to divide cost of the grading in each block length proportionately to frontage. Street intersections are divided into four quarters, and each quarter is assessed against the adjoining quarter block, though it was formerly the custom to assess for only 100 feet down each side from the corner. On streets traversed by street railway lines the cost of grading and paving is greatly lessened to the property owner, as the street railway company pays for the portion included by its tracks and for one foot on each side.

The assessments become liens on the property. Where it is not desired to pay them at once they are "bonded," that is, the time for payment is made ten years, and payment can be made in ten equal annual instalments, all deferred payments bearing 6 per cent. interest.

Bridges are always paid for by general taxation. Districting is only done in the case of sewers, where the main sewer and principal branches are paid for by an equal assessment over the entire district. The district method is the logical one in the case of sewers, the outlines being fixed in general position by natural drainage boundaries.

A CIVIC CENTER FOR SAN DIEGO.

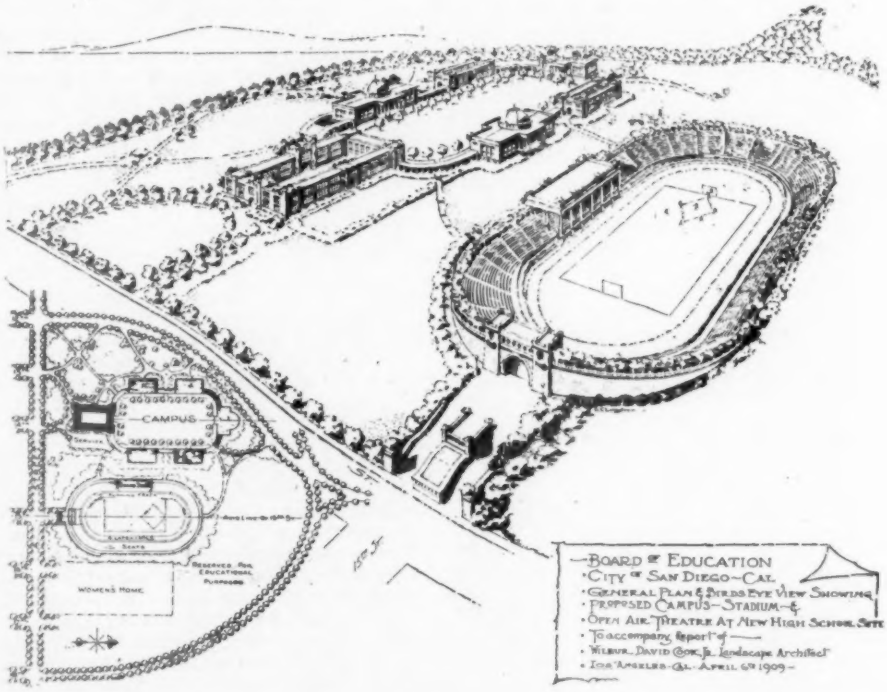
By Dr. Edward P. Bailey, Long Beach, Cal.

THERE is a commendable tendency in the leading cities throughout the world to build or to remodel the public centers, in line with some comprehensive civic scheme along artistic lines.

San Diego is the first city on the Pacific coast to adopt a comprehensive scheme for the grouping of public buildings. Sixty acres of the magnificent city park has been reserved for the erection of school and other public buildings and a plan for the development and improvement of this

tract, made by Landscape Architect Wilbur David Cook, Jr., of Los Angeles, has been accepted by the board of education and approved by the park commissioners.

A high school building has already been erected and the scheme provides for a group of five additional buildings, which include woodworking shop, foundry, machine shop, drawing school and power house, and an immense stadium with a seating capacity of 20,000. It will probably be a number of years before the complete scheme can be fully carried out, but work has already begun in accordance with the plans adopted. It is the intention to build immediately only the stadium.


CAMPUS
WOMEN'S HOME
RESERVED FOR EDUCATIONAL PURPOSES
BOARD OF EDUCATION
CITY OF SAN DIEGO—CAL.
GENERAL PLAN & BIRDS EYE VIEW SHOWING
PROPOSED CAMPUS—STADIUM—&
OPEN AIR THEATRE AT NEW HIGH SCHOOL SITE
TO ACCOMPANY REPORT OF
WILBUR DAVID COOK JR. LANDSCAPE ARCHITECT
LOS ANGELES CAL. APRIL 6TH 1909

Accompanying is reproduced a perspective of the proposed group of buildings and stadium and the field plan for the same. It gives a splendid idea of the natural advantages for attractive landscape work and shows how they have been used by Mr. Cook in the development of his scheme. The school reservation lies at the A street entrance to the park between Twelfth and Eighteenth streets. The stadium will be located at the head of Fifteenth street.

All of the school buildings are to be grouped around a campus 250 feet wide by 500 feet long, according to Mr. Cook's plan. Low colonnades or pergolas running completely around the campus will connect the various structures. The present high school building is 230x130 feet, two stories high, and has an inner court. It is built of blue limestone with trimmings and facings of artificial stone. When it was erected many persons thought a mistake had been made in making it so large, but it is already filled and it will be only a short time until more room is needed. All the new buildings will be designed to harmonize with this structure, which will be the dominant feature of the group. The proposed campus will occupy the space now given to an athletic field north of the high school building. It is proposed to surface the campus with some material which will give it a buff tone similar to that of the walks already constructed, and to treat the surface with a light distillate oil, which would go a long ways toward abolishing the dust nuisance. Trees are to be planted around the edge of the campus and curbs six inches high are to be run around all the buildings 20 feet from them. This will give a setting of greensward or shrubbery and will admit the area of maintained ground.

A natural ampitheatre has been selected as the site for the proposed stadium. This site was first recommended by the late George Cook, landscape architect to the city of San Diego. The natural contour of the side slopes suggests a stadium for this ampitheater as the slopes can be faced with reinforced concrete seats. Owing to natural conditions a stadium can be constructed at about one-half the cost of the stadiums at Syracuse or at Soldiers' Field, Boston. The Boston stadium was built up from a flat field calling for a concrete backing around the entire structure, whereas the San Diego stadium calls for a back construction only at the southerly end where the main entrance with towers and a broad archway will be located.

Plans for the stadium provide for an enclosure 300x800 feet, with a seating capacity of 20,000. The field trends north and south with a grandstand on the west side approximately 180 feet long. On the field will be a four-lap cinder running track with straightaways for a 100-yard dash. Inside this track is ample room for a baseball diamond and football field. There will also be a space for tennis courts at the north end of the field. A pergola treatment for the top of the stadium is proposed, adding lightness and color to the massive structure, and affording a fine promenade around the entire enclosure.

While the entrance is through an archway at the head of Fifteenth street passing up broad flight of steps to a general landing, this may be closed and the crowds can reach the seats by ramped walls leading to the top of the stadium on either side. This will make it comparatively easy to keep spectators off the field when large crowds gather. There will be room for shower and plunge baths, dressing rooms and for the storage of athletic equipment adjoining the towered entrance. An open air theater is planned to occupy the south end of the stadium, which may be surfaced with concrete. Sockets will be placed across the field, in which upright columns with clusters of electric lights can be set. Scenery may be suspended from these columns.

WATER STERILIZATION AT BOONTON, N. J.*

By George A. Johnson, Consulting Engineer, New York City.

THE purpose of this paper is to describe the methods of operation followed during the first three months' operation of the sterilization plant of the Jersey City Water Supply Company at Boonton, N. J. the historical phases of the subject and a description of the process and the plant at Boonton have been given in papers of Dr. Leal and Mr. Fuller. In this paper, therefore, only the methods of operation will be described, together with a discussion of the results of analysis of the raw reservoir water and the treated water made in the laboratory of the water company at Boonton and in the laboratories of Dr. George E. McLaughlin at Jersey City and Dr. Wm. H. Park in New York City.

Force Employed.—From September 26 to December 31, 1908, the operation of the sterilization plant at Boonton was under the direct charge of the writer. During that period Messrs. H. C. Stevens and Guy Britton were engineering assistants dividing the duties of the 24 hours of each day, and Mr. L. R. Whitcomb was analyst.

The duties of the engineering assistants were to superintend the preparation of chemical solutions and the application thereof to the water; to prepare accurate records of the rates of application of the sterilizing agent to the water; to collect and test at frequent intervals samples of the chemical solutions in order to ascertain the variation in strength of the same; and to prepare daily reports showing all necessary details of operation. Mr. Whitcomb's duties were to collect and analyze at least once a day samples of the raw reservoir water and of the water after treatment at a point on the aqueduct about one mile below the point of application of the sterilization agent; and, also, to carry on incidental studies to show the effect of the treatment on particular forms of bacterial life.

In the beginning each of the tanks in which the chemical solutions were

*From paper before American Waterworks Association.

mixed and stored was carefully calibrated and tables prepared showing the content of each tank at different depths. The orifices whereby the flow of solution was regulated were also carefully calibrated and tables prepared showing the discharge through each orifice under a constant head with the orifice opened to a varying degree. With a knowledge of the amount of water which was being delivered into the aqueduct, it was possible by means of these tables to adjust at the orifice the dose of chemical solution with a great degree of accuracy in a moment's time.

The bleaching powder was received at the plant in sheet-iron drums holding about 750 pounds, net. This powder was of a high degree of purity as ascertained by frequent analyses of it during the period of operation mentioned. Ordinarily the powder ran about 35 per cent. in "available chlorine," equivalent to 7.9 per cent. available oxygen. For the majority of the time solutions of 1 per cent. strength were used. For a part of the time, as is the case now, ½ per cent. solutions were used. By a ½ per cent. solution is meant the addition of 5 pounds of dry bleaching powder to each 1,000 pounds of water.

In making up a solution the amount of old solution remaining in the tank was first ascertained from the depth recorder and then it was decided to what height the tank was to be filled. By referring to the proper table showing the capacity of the tank between these two gage readings it was then possible to figure the amount of dry bleaching powder necessary to add to make up a solution of the desired strength. This amount of dry powder was then dumped into the dissolving compartment of the mixing tank, raw water turned on, and the agitators started. The solution rising in the dissolving compartment overflowed into the main solution tank, which was filled to the required height through this overflow.

When it was desired to throw a tank into use the proper valves were opened, connecting the suction in this tank with the chemical feed pumps. The solution was tested by the Penot method for its strength in available oxygen by the so-called "available chlorine" method and the orifice on the orifice tank adjusted to give the required dose.

The chemical feed pumps were always operated so as to pump a quantity slightly in excess of that discharging through the orifice, and this excess escaped from the tank through an overflow pipe leading back into the main solution tank. In this manner it was possible to maintain at all times a constant head over the orifice and if, for any reason, the feed pumps stopped, the level of the solution in the orifice tank immediately began to fall, causing an alarm to be rung notifying the operator of the fact. Very little trouble was experienced from clogging at the orifice, and the variation in rate of application of the chemical solution was, therefore, exceedingly slight, but practically negligible.

In the beginning, not having a thoroughly definite idea of the smallest quantities which could be used with satisfactory results, the amount of chemical applied was 1.4 parts per million of "available chlorine," corresponding to 0.3 part per million of potential oxygen, or 36 pounds of dry bleaching powder per million gallons of water treated. Gradually the quantity of applied chemical has been decreased until at the present time about 0.2 part per million "available chlorine" is being applied. This corresponds to 0.045 part per million of potential oxygen, or 5 pounds per million gallons of the bleaching powder.

There has been no striking evidence that the higher quantities were more efficacious in the destruction of bacterial life in the raw reservoir water than the small quantity last mentioned. The composition and temperature of the raw water apparently affected not at all the rapidity and completeness of the sterilizing action.

A long series of analyses were made with a view to establishing if possible a relationship between the amount of carbonaceous organic matter in the raw water and the amount of sterilizing agent necessary to effect the desired degree of sterilization. The quantities of the sterilizing agent used were so small, however, that there was found to be no such relationship existing. In other places, where the amount of organic matter is much higher than in the raw Boonton water, it is possible that such a relationship may be found to exist.

Records were tabulated showing the amount of water treated each day, the amount of chemical agent applied, expressed in parts per million of potential oxygen, the results of bacterial examinations to show numbers of bacteria in the raw and treated water, and of tests for B. coli communis carried on at Boonton and in the laboratories of Drs. Park and McLaughlin.

If there is an apparent disparity in

the results of analyses of the treated water at the Romine gate house and at the point of delivery in Jersey City, 23 miles below, and if the numbers of bacteria at the latter point were higher than those at the Romine gate house, as they sometimes were, it shows either that bacteria were still being washed from the old deposits in the conduit, or that there was a slight multiplication among the harmless forms of bacteria which successfully resisted the treatment. The completeness of the sterilizing action, so far as the destruction of objectionable forms is concerned, is apparent from the results. From October 10 to December 31, inclusive, the total number of bacteria in the treated water at the point of delivery in Jersey City averaged 15 per cubic centimeter, and only on one occasion out of 455 tests was B. coli positively isolated from the treated water at the point of delivery in Jersey City, namely, on November 1, 1908, when it was isolated by Dr. Park in 5 cc. of treated water collected at the Summit Avenue gate house in Jersey City.

Some time after the sterilization plant was put into service studies were inaugurated to demonstrate the efficiency of electrolytically-prepared hypochlorite of sodium. An electrolyzer was obtained from the National Laundry Machinery Company, of Dayton, Ohio, and this machine was set up in the gate house at Boonton and studies began. This electrolytic cell is of porcelain-lined pottery clay containing carbon electrodes and glass and carbon baffles. A solution of common salt of about 4.5 per cent. strength and having an initial temperature of about 65 deg. Fahr. was run through this cell at a rate of about 2 cubic feet per hour in the presence of a direct electric current of 110 volts and 22 amperes. The yield of a single cell was about 0.6 pound of available chlorine per hour.

Between the dates of March 20 and 24, 1909, a comparative test was made on the raw water to determine the relative efficiency of hypochlorite of lime in the form of bleaching powder and sodium hypochlorite electrolytically prepared. A considerable number of determinations of the bacterial quality of the raw and treated water before, during and after the use of the sodium hypochlorite solution showed that when equal quantities of the germicide in these two forms were added to the raw reservoir water the efficiency, so far as the destruction of bacterial life was concerned, was the same.

Under the existing circumstances the total cost which can be charged against the process when using bleaching powder was found to be $0.14 per million gallons of water treated, this figure being divided up substantially as follows, basing the figures on an average daily treatment of 40,000,000 gallons of water:

One extra operator	$0.065
Bleaching Powder	0.065
Coal for heating the plant, miscellaneous laboratory and other supplies	0.010
	$0.14

It may be well to point out that power costs nothing at this plant for the reason that it is obtained from a water wheel actuated by the water flowing through the pipes which deliver the water from the dam to the aqueduct leading to Jersey City.

With power costing nothing, the charge for electric current in this process is nil. It has been found that to produce a pound of available chlorine in the electrolytic cell requires about 8.5 pounds of common salt. This salt, delivered at the plant costs about one-third of a cent per pound; therefore, the cost for salt amounts to 4¼ cents per 1,000,000 gallons of water treated. The other figures previously given remain the same, making the total cost by the electrolytic process 11¾ cents per 1,000,000 gallons of water treated. In neither case has interest on the investment been included nor charges for depreciation in the plant. If this were added the total cost of the process would be between 20 cents and 25 cents per 1,000,000 gallons of water treated.

As to depreciation in either process, it may be well to point out that, although the plant has now been in operation over seven months it has not been necessary to replace any of the piping, pumps or valves, and such repairs as have been made are not worthy of mention.

In general terms when hypochlorite of lime or soda is added to water the chemical and physical characteristics of the water are changed to some extent. Through the action of carbonic acid, either free or half bound, hypochlorous acid is released from the hypochlorite, and this acid, although very weak, is an active oxidizing agent. In the presence of organic matter its oxygen is released and this attacks the organic matter and oxidizes it. As hypochlorite of lime is a mixed compound, composed of calcium chloride and calcium hypochlorite, it follows that the former will add to the hardness of the water. In the electrolytic

process where sodium hypochlorite is produced, the resultant solution contains in addition a slight amount of caustic soda and some sodium chloride, and the hardness of the water would, therefore, not be increased by its addition to it. In both cases the total solids in the water would be increased, and the color, if an organic stain, would be reduced. The carbonic acid in the water would be reduced, since it is essential for the liberation of hypochlorous acid from the hypochlorite.

In more concise terms it may be said that by adding hypochlorite of lime or soda to a water, the organic color thereof will be reduced; there will be an oxidation of organic matter; the carbonic acid will be reduced; the total solid matter in the water will be increased and, in the case of hypochlorite of lime, the total hardness of the water will be increased. With hypochlorite of soda this is not the case. All of the above changes were noted in a series of chemical analyses of the raw reservoir and treated waters. The amounts of chemical applied were so small, however, that the differences in the physical and chemical characteristics of the water before and after treatment were so slight as to be hardly noticeable and were well within the limits of accuracy of the methods of analysis.

The most important chemical change which is brought about in this process is the reduction of carbonic acid. This has considerable practical significance from a standpoint of the incrusting and corrosive action of water on iron and steel pipe brought about by the action of carbonic acid.

The claim has been made that free chlorine is liberated in this process, and that it may persist in water treated with hypochlorite of lime. This is in no sense true for the reason that free chlorine cannot be liberated from hypochlorite of lime or soda in a natural water. To do so it would first be necessary to decompose all the alkaline constituents in the water with an excess of strong mineral acid. Again, even if free chlorine could be liberated from hypochlorite of lime in a natural water, the chlorine would immediately combine with the hydrogen of the water and liberate atomic oxygen.

IRRIGATION BY THE CANADIAN PACIFIC RAILROAD IN ALBERTA.

THE development of some 3,000,000 of farming land in Southern Alberta by means of a system of irrigation was undertaken by the Canadian Pacific railroad in 1903. Approximately one-third of the work has now been completed, and the engineering and construction work upon the remainder is proceeding at a rapid rate. The whole scheme is the largest individual project in America, both in area effected, area actually irrigated and mileage of canals and ditches. The wonderful fertility of the soil and the character of the climate are such that both irrigated and non-irrigated lands are being sold as rapidly as the irrigation works are completed and the sections are opened for settlement. The unit of irrigation and of purchase seems to be the quarter-section, 160 acres, and the result of the present great activity will be within a very few years a thickly settled farming country with numerous new cities and villages calling for the application of the latest developments of the principles of municipal improvement and municipal government.

The earlier studies of the possibilities in the development of this district were made by the Canadian government under the able direction of Mr. J. S. Dennis, who is now the Chief Engineer and Superintendent of the Irrigation Department of the Canadian Paeific Railroad. These studies demonstrated the possibility of irrigating from one-third to one-half of the area of 3,000,000 acres lying east of the Bow river at Calgary and between the Bow and the Red Deer rivers for nearly 150 miles in a southeasterly direction along the railroad from that city.

That irrigation is desirable is shown by the records of rainfall, which have been kept at Calgary since 1885. They show that the total annual rainfall was as low as 7.'1 inches in 1892, but has been as high as 35.71 inches in 1902. The average for 23 years from 1885 to 1907, both inclusive, is 16.28 inches. One peculiarity of the

records is that in the 15 years prior to 1899 the rainfall was less than 16 inches each year, excepting 1888 when it was 17.51, 1896 when it was 16.05, and 1897 when it was 20.58 inches; whereas, in the nine subsequent years it has been more than 16 inches each year except 1904, when it was 11.16 inches. Of late years, therefore, it has been possible to raise large crops of grain and hay without irrigation, and the modern methods of farming are each year increasing the profits from cultivating the non-irrigable land. This makes the legal duty of water, 150 acres per second foot, based on a continuous flow during 153 days between May 1 and October 1 more than ample. The evaporation is not far from 17 inches during the same period.

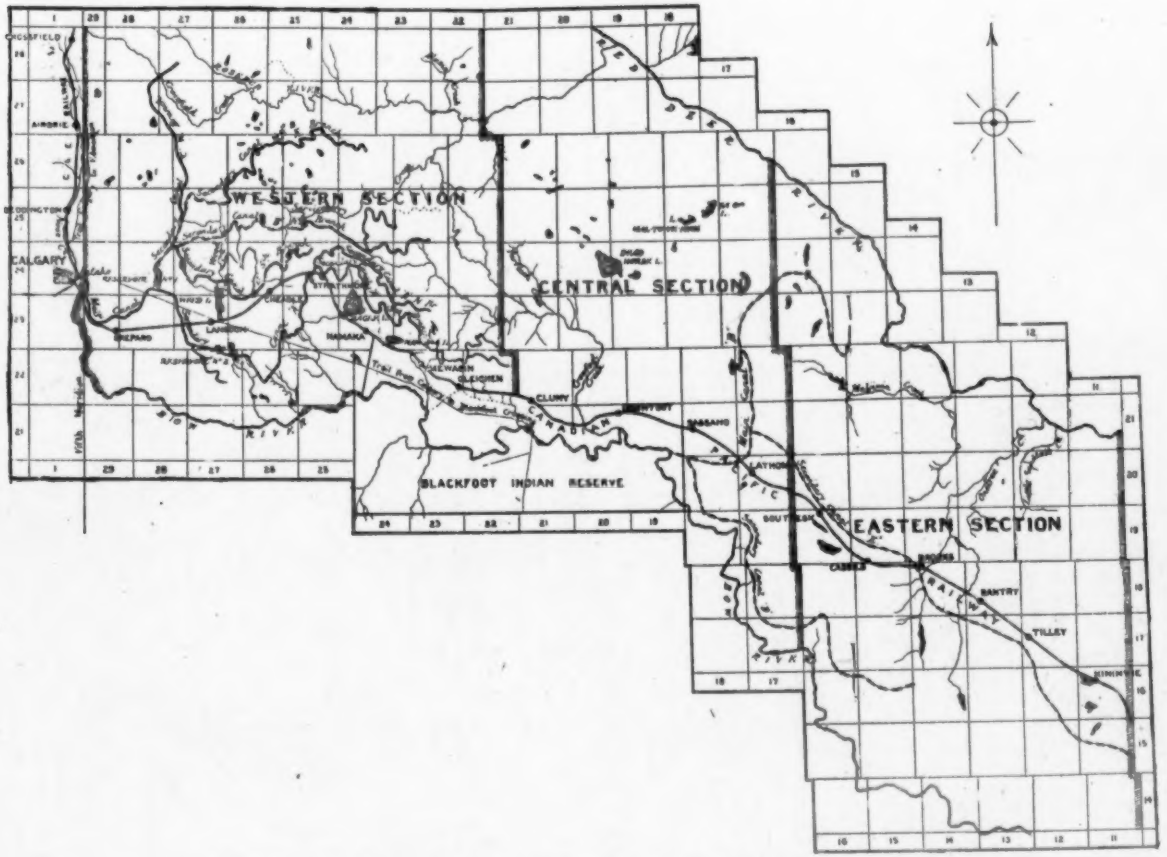
These figures have nothing to do with the capacity of the Bow river to supply the irrigation canals, since the river is never at its low stage during the legal irrigation period above named, and its discharge is generally from 20,000 to 40,000 cubic feet per second during those months, whereas the capacity of the main irrigation canal, to serve the western section, where it leaves the river two miles below Calgary, is but 2,000 cubic feet a second.

There is, therefore, no question of sufficiency of supply of water. The non-irrigable lands in the district are so classed because they are upon hills too high to be reached by the ditches. In the western section there are about 1,000,000 acres of land, of which about 350,000 are under the ditches. This area is a rolling prairie, quite sharply so in the vicinity of the larger streams, but as the work proceeds farther east it will come into more level ground and a larger proportion will be irrigable. The detailed surveys are in progress in the central and eastern sections and information about them is restricted to the general results of the earlier studies and the preliminary surveys for the main ditch lines.

This tract of land came into the hands of the Canadian Pacific Railway through the desires of the railroad management and the Canadian government to settle the country. Originally the Canadian Pacific had a grant of each alternate section in a strip of land 24 miles wide on both sides of the line, but had the privilege of locating the land pertaining to the line through Saskatchewan and Alberta in other districts because these lands were not "fairly fit for settlement." Some 3,000,000 acres of lands had not been chosen by the railroad when the government studies demonstrated the value of these same Alberta lands and the possibility of irrigating them. Then, by an agreement whereby the railroad would receive the lands in a solid block, instead of in alternate sections, they were located in the area described and shown in the accompanying map, and the company began the detailed surveys in 1903, the construction in 1904 and the sale of lands in 1906.

To the novice the problem of carrying the irrigation canals through and around the sharply rolling country at the western end appears to be extremely difficult, and for the engineer it means detailed contour surveys of almost the whole of the area of the western section and many miles of ditch location surveys. There is no difficulty regarding the sufficiency of fall to carry the water in the ditches. The difficulty is all in providing means for breaking the fall of the water so that it will not wash out the ditches. The river has a fall of some 1,100 feet in the 120 miles air-line distance across the irrigation tract, or nearly ten feet to the mile, whereas the main canal has a fall scarcely more than one foot to the mile. This means that there are numerous vertical drops in the main and branch canals at their junctions, and in the irrigation ditches themselves there are often long distances in which the water must be let down a slope by vertical drops at short intervals. This makes the disposition of surplus water ordinarily easy, for it can be turned into the numerous surface drainage channels and small streams and thus find its way promptly to the main rivers with very little work in preparing drainage channels. The remarkable feature of the location of the canals and ditches is the small percentage of flumes and embankments required. For so rolling a country this gives evidence of careful and detailed work as well as expert engineering ability. The result is a minimum of danger of lack of water from accidents to the canals, for there are practically no structures, the breaking of which will turn the water out of the canals after it has once reached them.

It has been decided to take the water to irrigate much of the central section from the Calgary intake, which will necessitate an enlargement of one canal line through the western



MAP OF IRRIGATION SECTIONS IN ALBERTA ON CANADIAN PACIFIC RAILWAY.

section and the construction of a flume 1,700 feet long and 60 feet high.

In the western section there are 17 miles of main canal, 150 miles of secondary canal and 800 miles of distributing ditches to insure the delivery of water at the highest irrigable point in each quarter section of the 350,000 acres which are irrigable. This is a total of 967 miles, and each farmer will add his quota to the hundreds of miles of small distributing laterals necessary to distribute the water over these quarter sections. The main canal will require 2,500,000 cubic yards of excavation, the secondary canals 5,000,000, and the distributing ditches 1,750,000, making a total of 9,250,000 cubic yards. About 83,000 linear feet of piles and 8,190,000 feet B. M. of lumber have been used in building the thousands of headgates, spillways, drops, flumes, measuring weirs, highway bridges and culverts which have been built in the western section. The preliminary surveys indicate that the work in the other sections is proportionately as great.

Some details of the engineering work will be described in a future article.

SIDEWALK AND CURB DESIGN AND CONSTRUCTION.

IN COMMON with most cities in New York, Poughkeepsie leaves much of the work of constructing sidewalks, curbs and gutters to the owners of the abutting property, taking charge of the work as a whole only when a general improvement of a street is petitioned for. The Board of Public Works has recently issued a pamphlet of information and instruction regarding the construction of such improvements, which is quite fully illustrated with views showing the practice in other cities. The Board issues permits for such private work on the public street, furnishes stakes and grades and inspects the construction. The booklet contains specifications for various kinds of materials and standard methods of construction. Some selections from the instructions follow, and show what is considered satisfactory practice in the smaller cities of the east.

It is the desire of this Board that a definite line of improvement shall be adopted relating to sidewalks, curbs and gutters and finally have uniformity of construction on each street of the city.

Property owners desirous of improving the sidewalks, curbs and gutters, by applying to the Board of Public Works may obtain the information necessary for the permanent improvement and obtain the grade and alignment for the same.

Permission must be obtained from the Board of Public Works to set new curb or gutters, reset old curb and gutters, to lay a new sidewalk or relay an old sidewalk.

The style of construction in the above mentioned cases shall be uniform on each side of the street for each block.

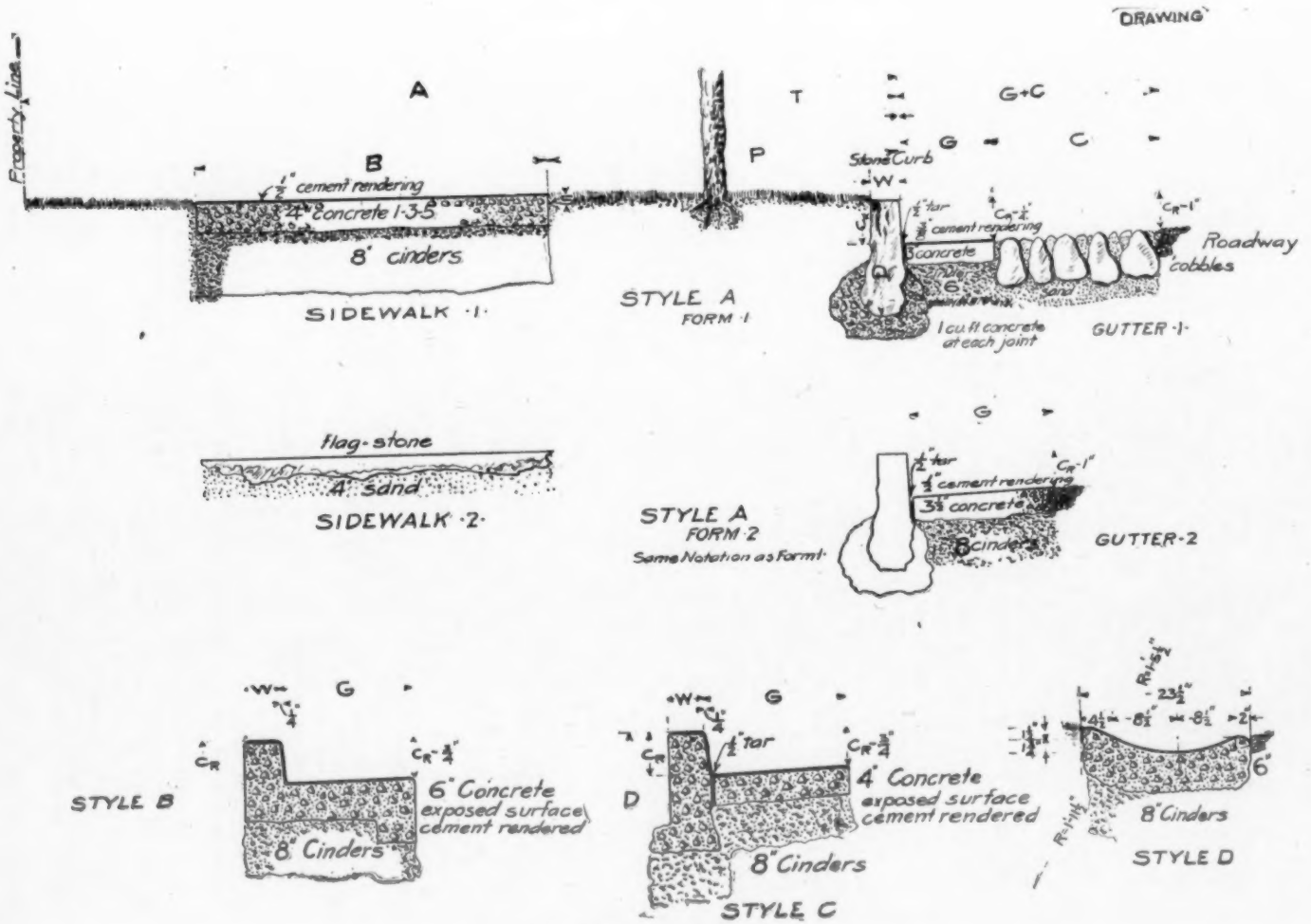
Sidewalks of a permanent nature only, such as cement, tar, stone or vitrified brick will be considered by this Board.

All work shall be done to the grade and alignment established by the Superintendent of Public Works.

The Board will furnish special designs for drive-ways.

In the case of a property owner desiring to make improvements in advance of a general street improvement, the Board upon granting a request to a property owner to set any new curb and gutter, reset old curb and gutter, lay a new sidewalk or relay an old sidewalk will at the same time furnish plans if necessary and specifications to be followed in doing the work for which the permission is requested. The one receiving the permit may make such arrangements for having the work done as he wishes, but to the satisfaction of the Board of Public Works. The Board will inspect the work and see that the specifications are carried out.

In the case of a general improvement of a street or section of a street where the improvement is petitioned for or ordered by the Board, the Board will consider the desires of the property owners as to the material used. When the nature of the improvement is decided the Board will attend to the execution of the work according to their plans and specifications and assess the cost by the



I. SIDEWALKS AND CURBS.

General Designs in Use in Poughkeepsie, N. Y.

method presented in the charter.

The person receiving a permit agrees to comply with the conditions stipulated in the specifications and will uphold the inspection of the Board.

A curb is placed in a street to mark the division between the sidewalk and roadway and is especially necessary in all streets having a block or brick pavement. It keeps the water confined and protects the sidewalk.

The location of the curb lines is of very much importance and before any definite conclusion is made careful study should be made of traffic conditions. In purely business sections there has always been a tendency toward wider and wider roadways, so much so that in many cities in the very heart of the shopping districts there is congestion on the sidewalks.

On 23rd Street, New York, in the shopping district between Fifth and Sixth Avenues are examples of very wide sidewalks, as well as 42nd Street. It is generally desirable in business sections to have wide sidewalks and wide roadways. The residential portions are very different and should be treated from an entirely different viewpoint.

The designers of many of our cities have had no definite ideas as to the location of business and residential sections, and as a result we have conditions of curb line locations and street widths that might well be reversed.

Residential sections do not require wide sidewalks to accommodate the public, neither do they require wide roadways, so that wide streets have been taken advantage of in parking their roadways from the curb to the flag or walk, thereby narrowing the roadway and giving place for a lawn and row of trees on each side.

This takes the roadway further from the residence, makes sprinkling more effective, is cooler and gives a good balance to a street's general appearance.

In business sections this common rule has been followed, "Two-fifths of roadway in sidewalks and three-fifths in roadway." In residential sections one-half for each is common practice. A wagon seldom occupies more than nine feet in width, eight being the ordinary over all width. Eighteen feet between curbs will permit two wagons to pass with ease. Twenty-seven feet allows a wagon to stand on one side and two to pass. Thirty-six feet will allow a wagon at each curb and two to pass between.

Where the pavements are of gravel or macadam curbs are not necessary unless it is a business street, or partially so. Purely residential streets with a pathway of trees and grass on either side of the roadway do very nicely with the simple flat gutter of cobbles or concrete.

Stone curbs are not used as much as they were, concrete taking their place. It has been found that concrete when properly laid gives a more regular appearance and is much cheaper. A concrete curb and gutter combined is perhaps as handsome and as reasonable a combination as can be used for such a purpose.

A concrete curb when used in a business section where wagons are constantly running against it and grinding and chipping the edges should be reinforced and have a wearing edge of steel. When such cases arise it is better to use the very hardest and toughest stone available.

A stone curb of softer composition is often used in place of concrete on residential streets when a permanent pavement is to be laid because such material can be easily sawed into exact shape and be given a uniform finish and at no great expense.

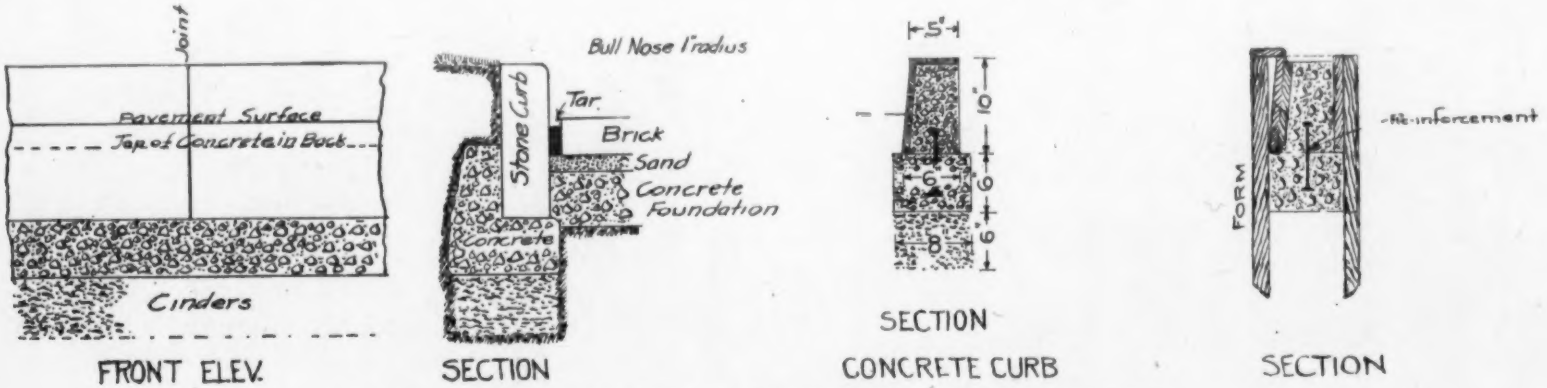
This class of stone is called sandstone, particularly the Ohio sandstone, which is very soft when quarried, but becomes hard with age and slightly discolored. This stone cut into pieces 5 inches by 16 inches with a bull nose and tooled face makes a street look its best.

In streets of heavy traffic the blue stone or granite is much more serviceable. In such cases the stone is not sawed from the quarry and tooled faces are not obtained. The curb can be gotten out in regular and exact shape and with a very good finish, but it is quite expensive. The seconds and thirds from blue stone quarries make a serviceable curb, but do not present a regular or pleasing appearance.

Medina sandstone is used for curbing to a very great extent, especially in Western and Central New York.

Concrete curb as well as stone curbs, whether or not the stone curb has a concrete foundation, sometimes has a sub-foundation of soft coal cinders, but it is only necessary in impervious soil. Such material furnishes and prevents the frost from displacing the curb as well as the sidewalk.

To set a stone curb without some foundation or some protection from



II. STONE AND CONCRETE CURB, AS CONSTRUCTED IN POUGHKEEPSIE, N. Y.

overturning besides earth being tamped about it, is not good practice and should not be tolerated. One can easily tell whether the curbs of a city are properly laid by a glance over its streets.

While the initial cost may be more, when laid properly it is the cheapest in the long run and much more satisfactory.

An inexpensive method for setting curb, and one which gives fairly good results, is the placing of one cubic foot or more of concrete about each joint. This seems to furnish sufficient bond to keep the curb in alignment and prevent the overturning or dipping. The added expense should not be over eight cents per foot. The best method is to place a concrete foundation about the curb throughout. The concrete on the cinders with proper provision made for the drainage of the cinders wherever a sump may occur. This would probably add from twenty-five to thirty-five cents per foot to the curb setting.

Gutters are placed where the concentrated flow of water from the drainage of a street occurs. Of course this is at the curb. The gutter is placed to protect the roadway at the curb from erosion. It is very evident that the steeper the grade of the street, the more necessary it becomes for a gutter. A gutter, however, has another function to perform and that is the resistance to heavy vehicles against the edge and the tendency to displacement.

In roadways of gravel and macadam where gutters are necessary cobbles and flagstone strips have met the condition very well, but at present there is a tendency toward the use of concrete for this purpose. In concrete any shape may be procured and some very pretty gutters can be made so as to do away with the necessity of a curb.

The combined concrete curb and gutter is very often used and when properly constructed gives a most pleasing appearance and a feeling of permanency.

Stone sidewalks or flag walks have been universally used for years, so much so in this locality that it is quite generally believed that bluestone is the only stone that can be used for sidewalks. It is unquestionably the toughest, but it does not give as regular and nice appearance as some of the sawed flags do of the other kinds of stone.

The practice of stone walks seems to have suffered of recent years, so much so that in some sections walks of stone are not permitted, concrete walks having supplanted them.

Stone sidewalks are surely much better than poor concrete walks and there are certainly a large number of very poor ones. Over-confidence in the mixture of stone, sand and cement and ignorance of the necessity for proper proportions is probably accountable for poor concrete sidewalks. It is not unusual to see concrete sidewalks uneven, warped, cracked and cleaved and some wearing out in a very short time. The same with stone walks, some are uneven, making places to stub one's toes, irregular in alignment, some cracked into a dozen pieces presenting in all a most untidy appearance. The reason for such stone walks is that they are not properly bedded, the stones are not thick enough and they are not the fair run of the quarry, nor properly squared.

It should not be understood that it is impossible to get a good flagstone walk.

Cement or concrete sidewalks are easily made and reasonably made, but care should be used in the selection of the materials which go to make up your walks, care in the mixture of the materials as to proportion and thoroughness and great care in its treatment while setting is taking place.

Sidewalks generally have a slope of ¼ inch to the foot toward the curb, sometimes in parks or where the sidewalk is wide enough, instead of a side slope, the walk is made to crown in the center.

Coloring matter should not be used in a cement sidewalk, as it fades and does not add to the quality of the finishing coat.

Driveways are generally specially designed and are marked across the surface with parallel lines one inch apart, by the use of a line roller.

The accompanying drawings and photographs, for which we are indebted to Robert J. Harding, Superintendent of Public Works, show the standard designs adopted by the Board, dimensions varying with the street widths and the other conditions named above.

Plate I shows the ordinary treatments of sidewalks, curbs and gutters. The cobble gutter in Style A is a remnant of the ancient cobble stone streets which formerly existed without competition, and which were

III. STREET AND SIDEWALK DESIGN IN HOLYOKE, MASS.

IV. DESIGN OF A BROAD STREET IN CLEVELAND, O.

long considered the only paving material possible on the steeper streets running up the hill from the Hudson river, on which much of the city is built.

Plate II shows plans for setting stone curb and for laying reinforced concrete curb.

Plate III shows a tar macadam street with brick in the street railway track, and cut granite curb in Holyoke, Mass., excellent construction and possibly as good a design as is possible under the circumstances, although the lawn between the sidewalk and curb is reduced almost to the vanishing point.

Plate IV shows the better design possible in a wide street in Cleveland, O. This is a brick street with a 5 by 24-inch Berea sandstone curb which has been in service for 24 years. The wide grass plot makes it possible to carry the heavy wiring along the curb without seriously interfering with the trees. It is a disfigurement at the best.

Plate V shows the location of the cement sidewalk against the curb on a street in Niagara Falls. The roadway has every appearance of too great width for the amount and character of traffic on the street, and the addition of the sidewalks without the relief of a lawn increases the barren appearance of the street.

Plate VI shows an answer of the vexed question of treatment of sidewalks at intersections, where heavy excavations are necessary, made by Henry C. Allen, city engineer of Syracuse. The intersecting street is not yet brought to its final grade and its street pavement has not been laid, but the location of the sidewalks and the treatment of the slopes and the steps at the corners give an ample suggestion of the final result. The trees have been carefully taken care of, and it will only be necessary to remove the poles to make a handsome street corner.

A similar location of one sidewalk is shown—Plate VII, from Ithaca, N. Y. The photograph also shows a curved or hollowed concrete gutter with a concrete curb, a form which should be quite satisfactory on a macadam street where the amount of water to be carried is large and the grade is steep.

Plate VIII shows another and a handsome street in Ithaca, with a 24-inch concrete gutter and a concrete curb of the usual design. The crown of the roadway is excessive, especially for a street with as steep grade as this seems to have and as many changes in gradient. Sidewalks and lawns are well treated in this street and the trees show less neglect than is too frequently the case.

TYPES OF MODERN BOILERS.*

By John W. Hill, Consulting Engineer, Cincinnati, O.

THERE are three distinct types of boilers now in general use for steam making, as follows:

1. The plain return tubular boiler, set in brick work, and exposing the under part of the shell to the action of the hot gases, before they ascend at the back end to return to the furnace end through the flues or tubes, and pass up through the uptake and breeching into the chimney.

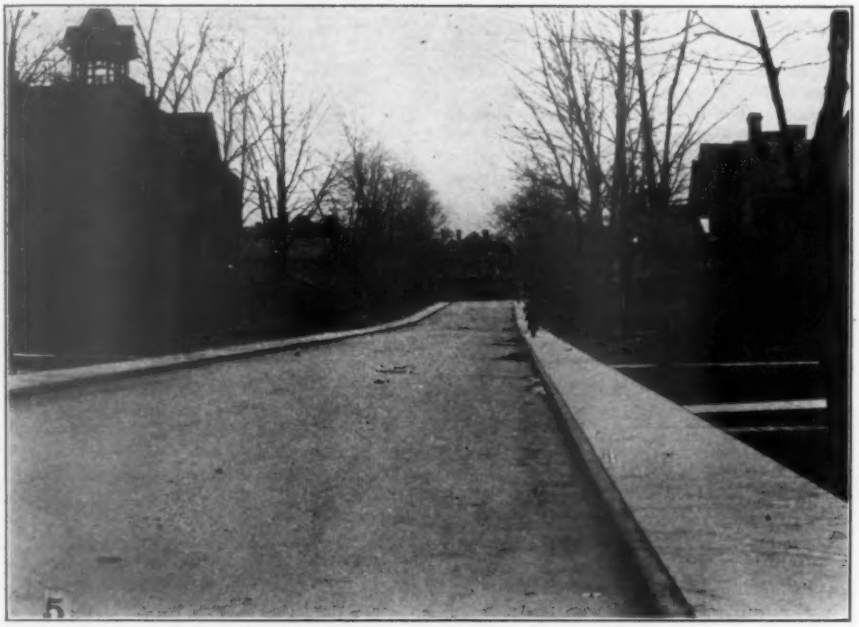
2. The fire box boiler, which requires no brick setting and is complete when it leaves the boiler shop. This type embraces marine fire box direct and return tubular, and locomotive boilers, and is largely used for marine and portable purposes.

3. Water tube boilers, set in brick work with the hot gases passing around the tubes, of which the Babcock & Wilcox is now the oldest and best known example.

During the past twenty-five years, steam pressures in stationary service have been raised from 100 to 160 lb. per square inch and even to higher pressures; and in a few cases to pressures as high as 280 and 300 lb. per square inch, and our practice in stationary boiler construction, in vogue twenty-five years ago, has been materially revised to meet the new conditions.

There may be boilers in use under modern conditions of service which may be embraced in the classification above given, but the purpose of the paper is to deal only with the standard and well-known types.

*From paper before American Waterworks Association.



V. POOR STREET DESIGN IN NIAGARA FALLS, N. Y.

VI. ONE SOLUTION OF A DIFFICULT STREET INTERSECTION PROBLEM IN SYRACUSE, N. Y.

RETURN TUBULAR BOILERS.

Return tubular boilers are made and offered in the market as "standard" boilers up to 84 in. diameter and 20 ft. long, to carry 150 lb. pressure per square inch. The shell of this boiler is 9-16 in. thick, with triple rivetted butt joints. Assuming sheets of a strength of 55,000 lb. per square inch of section, and allowing 74 per cent. of the value of the plate for triple riveting, the factor of safety for such a boiler at 150 lb. pressure will be 3.586, which seems to be too low a measure of safety for steam boilers. This boiler is rated at 225 h.p.

Return tubular boilers set in brick work are rarely used for steam pressures above 130 lbs. per square inch.

This type of boiler, however, for the pressures which it will safely carry, is economical in the use of fuel, and has many friends among steam users, but owing to the demands for increased pressures, for high expansion engines, some other type of boiler must be sought. Of course by making the shell plates sufficiently thick, the return tubular boiler may be adapted to high pressures, but only with a sacrifice of economy. The large and comparatively thin shell surface constitutes the chief merit of this type of boilers, and when thickening of the shell to meet high pressures is resorted to, the transfer of heat from the furnace to the water is slower, and the amount of heat absorbed by the water from the shell in a given time, is proportionally reduced. The bulk of the work, as stated, in a return tubular boiler is accomplished by the shell and it is only with thin shells that high fuel economy can be obtained.

FIRE BOX BOILERS.

The fire box boiler of the locomotive type with thin water legs is too well known to call for special description. I am not aware that such boilers have ever shown high economy of fuel and they are used now only when no other type is quite as convenient, but for locomotive, contractors' equipment, traction and farm engines, and service requiring portability, this type of boiler will always have its place, and within its range of capacity and economy will always be in favor. Tests made a number of years ago with a Baldwin locomotive indicated that with the water legs clean and the fire box surfaces in good condition, from 75 to 80 per cent. of the steam was made in the fire box, and from 20 to 25 per cent. of the steam, in the tubes. At the same time, the temperatures of hot gas taken with a pyrometer, in the smoke head showed from 1,000 to 1,100 deg. Fahr., indicating that at least 50 per cent. of the heat of the fuel was lost in the stack.

The marine fire box boiler, with corrugated fire boxes of the Fox-Morrison type, is an ideal boiler for high steam pressure and high economy, and barring cost will meet all conditions now set up for modern boiler practice; such boilers have been fitted with underfeed automatic stokers, but they are better adapted to hand firing, and in test trials and otherwise have made records for economy that cannot be excelled.

These boilers have been built with return tubes, in which case the fire box is continued of full size from the front to the back head, at which point a separate steel combustion chamber lined with fire brick is formed, and the hot gases are conveyed to the tubes through the combustion chamber. At the front end the boiler is provided with an uptake leading to the stack or to a breeching connected to the stack, in this respect resembling the old standard return tubular boiler.

Another form of marine fire box boiler has the combustion chamber at midlength of the shell, the fire boxes extending from the front head of the boiler to the front sheet of the combustion chamber, and the fire tubes extending from the rear sheet of the combustion chamber to the back head of the boiler. In this form of boiler, the hot gases are usually brought forward under the shell and drop into a flue or downtake which leads to the stack.

The marine type of fire box boiler has been so thoroughly tried out in ocean-going vessels that aside from cost and floor space required, it may be regarded as capable of satisfying all conditions for high economy of fuel and high steam pressures.

WATER TUBE BOILERS.

The water tube boiler is a comparatively modern invention, although several attempts have been made at different times during the past century to develop a boiler of this kind for steam pressures as high as any carried today. Jacob Perkins and others, eighty years ago, had as accurate a conception of the advantage of high pressure steam as we now have, but he lacked the boiler to make it economically, and the engine to use it in after it was made, and high steam pressure waited until the modern water tube boiler and triple expansion and turbine engines were designed. It is probable that the boiler led in the ad-

vance of steam pressure and engine economy, and that the development of the modern high duty engine followed. At any rate, a plain compound engine with pressures of 100 to 120 lb. per square inch, could give all the economy of steam practically possible at these pressures, and higher economy of steam consumption meant higher steam pressures and the division of the engine work among more steam cylinders.

In discussing boilers and their effect, I am having in mind principally water works practice, although so far as the boiler is concerned, the economic effect would be the same in any other field of steam power development.

Originally the water tube boiler was sold upon its merits as a safety boiler; steam pressures carried were no higher than with shell and locomotive boilers; indeed, locomotive boilers for years have been worked at pressures of 150 to 180 lb. per square inch and plain return flue boilers 48 and 54 in. diameter of shell and 28 and 30 ft. long on western river steamboats have carried 200 lb. pressures since steam boating became an art. The pressures on railroads and steamboats were not designed for economy of steam consumption, but to enable a small engine to pull a large load, and long before the water tube boiler became a marketable commodity, high steam pressure with locomotive fire box and return flue boilers was well known, and when one of these boilers let go from weakness or excessive steam pressure, it made people sit up and take notice, that is, those of the people in the locality who were able to sit up after the explosion.

The danger from explosion in stationary practice has been largely reduced by the water tube boiler, and its merit in this respect has compelled the manufacturers of shell and plate boilers generally to demand better materials and perform better work, to render the other types of boilers equally safe under the allowed working steam pressures.

The water tube boiler has, however, done another thing; it has set a new standard of boiler economy and made each pound of coal do more work, furnish more power and give a better account of itself in the furnace, than it usually did before, mainly by reason of the fact that such boilers with a little care can be practically renewed from time to time and put in condition almost, if not quite equal to new. Excepting the water tube boiler and its setting are kept in good condition, I have found that the economy falls off more rapidly than with shell or fire box boilers, and the neglect which the latter kind of boilers often suffer is not admissible with water tube boilers without exciting notice.

The early Harrison sectional boiler made up of cast iron hollow spheres about five inches diameter and put together on ground joints, was popular at one time upon the sole ground of sofety, it being argued that in a case of overpressure or weakness of a unit, that one unit only could break, whereupon the pressure would be lowered, and aside from the possible scalding of men in the fire room, no serious damage could follow the rupture of one of the spheres. I do not recall that much was ever said for this boiler about economy of steam production, and it is not probable that it was an economical boiler for heat transmission, for cast iron is not as good a conductor of heat as wrought iron or steel plate, and the thickness of the cast iron sheets was even greater than the usual thickness of shells in return tubular shells and fire boxes and tubes in marine boilers, and tubes in water tube boilers.

In water works practice each kind of boiler has its champions and it has been my good fortune to try out each kind with gratifying results. With pressures not in excess of 130 lb. per square inch the plain return tubular boiler carefully set, with grates and furnace adapted to the fuel to be burned and hand fired or with a good automatic stoker will give a satisfactory economy and capacity for heating surface, and will contribute its share toward a high engine duty.

The marine fire box boiler with return tubes, which is found in many pumping stations in the east and represents exactly the kind of boiler almost exclusively used in ocean-going steam vessels, when fired with either hard or soft coal has given economic results not to be surpassed.

From personal experience with marine fire box boilers, I prefer the return tubular type in which the hot gases are taken upward from the front end of the boiler to the chimney. In this type the course of the hot gas is horizontal and upward, although the experience of others has shown that the marine boiler with the combustion chamber in the center instead of at the back end, has given equally as as good results.

EDITORIAL COMMENT

The Peoria Electrolysis Case.

State Regulation of Electric Light Rates.

Engineering Contractors.

THE PEORIA ELECTROLYSIS CASE.

Some ten or a dozen years ago the Peoria Water Works Company brought suit against the street railway company on account of the damage to its water pipes from stray electric currents escaping from the street car rails. A special master heard evidence for about a year, heard arguments a year or so later and gave his report a year or more later, on May 30, 1901. Arguments on this report were heard more than a year later and nothing further was done, aside from the court's ineffective efforts to secure further evidence on his own account until 1907, when at the court's suggestion the case was transferred to another judge. This judge appointed the same special master to receive new evidence, which he did more than a year ago and has recently made his second report.

Both reports are strongly in favor of the water company, the second quoting three conclusions from the first as having been confirmed by the additional evidence. They are:

A difference in potential of the fraction of a volt may cause electrolysis and from the conditions hereinabove found and stated, the ultimate destruction of complainant's pipes by the currents of electricity allowed to escape from defendant's system is a question only of time and presence.

The evidence discloses no known method by which the complainant, by its own action, can protect its water distributing system of pipes and mains from the electric currents of the defendant's single trolley railways.

The evidence discloses no complete remedy for the injury to these water pipes, except the entire removal of electric currents from the water mains; such removal is impossible as long as the return currents of the electric railways are grounded or in electrical contact with the earth. The other methods which have been suggested by the defendants in this case do not in practice and cannot prevent the escape of a portion of the current into the ground and water pipes.

This report is made to the judge in a U. S. District Court and is presumably the basis upon which the judge will base his decision regarding the responsibility for the damage which is undoubtedly occurring and possibly the amount of such damages and by whom they shall be paid.

While this is not now a record-breaking case as regards the time it has been in court, it may be unless the new judge is more expeditious than the former. The suit being between two corporations, there has been no newspaper to denounce the court for failure to defend the rights of the people. One of the notable facts in the case is the statement by the judge that there has been no advance in the art of taking care of such stray currents and that such improvements as have been made in the methods of returning current to the dynamo by underground routes have not kept pace with the increase in the street car system, so that the water pipes are in certain districts even more subject to damage than when the suit was begun. Some of the engineers called by the former judge refused to testify because of the injury their testimony might do to their business.

All these things indicate that the delay is due, not to undue influence of any sort, but rather to the reluctance of the court to make a decision upon a case in which the engineers are at a loss to supply the necessary technical advice, aside from that quoted above from the paragraphs of the report, "entire removal of electric cur-

rents from the water mains, which is impossible as long as the return currents of the electric railways are grounded or in electrical contact with the earth."

Periodical payments to the water company of damages, reduced to a minimum by following the best practice under present methods, would be less expensive than the reconstruction of wiring systems which this would demand, and the disproportion of damage to cost of removing the danger of damage is a large factor in the generation of disinclination of both engineers and lawyers to render such a decision. However, the damage is done and it must be paid for. The question to be worked out is as to the most equitable way of taking care of it. If the courts cannot decide under our present laws we should be able to work out a law by means of a special commission which will offer a practicable plan.

STATE REGULATION OF ELECTRIC LIGHT RATES.

A recent decision of the Railroad Commission of Wisconsin of an application from the Stoughton municipal electric lighting system for authority to modify its rates shows the thoroughness with which that body enters into the questions coming before it and the educational value of such a commission.

The desire of the petitioner seems to have been to obtain a more flexible rate schedule so that current could be sold to factories for power, giving inducements to long-hour users and large consumers; also to incorporate a 5 per cent. discount to all consumers for prompt payment to aid collections.

With the application were presented exhibits of the operating expenses of the plant for a year, the plant valuation, the bonded indebtedness, the revenues per month and for each class of service, the connected load and the peak load of the plant, and the load for a single day. This information was supplemented by inquiries made by the commission, and comparative tables were prepared as a basis for investigation of the present rates, the effect of the proposed changes and the effect of the changes recommended by the commission.

The order was to discontinue the present rates and to substitute either the rates suggested by the Commission or the rates applied for by the petitioner, with three rather unimportant modifications.

In the discussion of the case the Commission goes into considerable detail.

It first makes a check upon the valuation of the plant by comparison with general results.

The incomes for three years, two of them overlapping, are compared and show fair uniformity, with allowance for the new competition of a private gas company.

The operating expenses for two years are itemized and found to be uniform and not excessive. An allowance for taxes of 1 per cent., one of 3.2 per cent. for depreciation in the plant, excluding the new water-power, also one of 7 per cent. interest on the investment, were made in computing unit costs, which increase the charges against the plant by about 70 per cent. of the operating expenses. If the interest on the bonded indebtedness only is charged, the increase in charges is only 35 per cent. of the operating expenses.

The details of the load on the plant are given as to classes of service as a basis for classification of rates and determination of the effects of changes of rates upon the total income of the plant. The maximum demands, the total consumption, the number of consumers and classification are also given.

Then a study is made of the active load as a basis for determining the fixed expense each unit of load should bear, whether current is used or not. The total active load on the assumptions made is computed to be three-fourths of the connected load in kilowatts.

Then the hours of use by the various classes, the revenues per kilowatt connected and per kilowatt used

are computed on the basis of the active load table, and these results are compared with similar results in other cities.

The fixed or capacity costs for each class of light and per motor horsepower per month and year, and the variable or output costs per kilowatthour are collected, and the costs per unit for arc lights, incandescent lamps, and motor horsepower are worked out as well as the flat rate for incandescents on the estimated average hours of use.

These "readiness to serve" rates are reduced to "maximum demand" rates for various hours of use per day from ¼ to 24 and they are compared with the present rates, which correspond to the demand rates for about 1 to 1½ hours' use per day.

From these two tables the Commission derives the schedule of rates which it recommends, stating that the meter rates may be said to represent a sort of combination of the "readiness to serve" and the "maximum demand" systems of charging. These rates are compared with the rates proposed by the petitioner for commercial lighting and show equality for small users, and with few exceptions slightly higher bills for large users under the petitioner's schedule.

The total revenues under the Commissioners' rates and under the present rates are computed as nearly as may be and show reduction in revenue from metered and flat rate incandescents and increase in revenues from power and from municipal lighting, the total reduction being about 10 per cent. Minimum bills of $1 a month for power are recommended, also 75 cents for lighting, per meter.

The final rates recommended by the Commission as approximating rates fixed on a scientific basis are 10 cents per k. w. for the first 30 hours' use per month of active load and 6 cents for all over; 8 and 5 cents respectively for power; incandescent lights flat rate ordinary use 35 cents for 16 cp. equivalent per month, all night, 50 cents. Discount 5 per cent. for payment before 10th of month. Churches and residences to be considered as having active load 50 per cent. of connected load.

Detailed study such as this will ultimately put lighting rates on their proper basis. They have been on a better basis for years than the rates for water. It is to be hoped that this Commission or some other will have an opportunity soon to treat the water rate question in an equally exhaustive manner.

ENGINEERING CONTRACTORS.

The invasion of the contracting field by engineers is demonstrated by the rapid growth of the American Society of Engineering Contractors, which was organized in April and publishes a list of 1,300 charter members. The society has offices at present in the Park Row building, New York, with Daniel J. Hauer, the secretary, in charge, and enough money in sight to pay the expenses of the first year.

The first convention of the Society, following that at which it was organized, will be held in Chicago on the last three days of the great cement show, Feb. 24, 25, 26, 1910, and gives every indication of being successful in numbers and the management is certainly capable of making it successful in the lines of interest, instruction, entertainment and good-fellowship.

The constitution is broad enough to admit those who are interested in making the association valuable and it is apparently the intention to make it independent enough to keep clear of petty jealousies, so that it will be worth while for both engineers and contractors to take hold and help the society take the position it should in the common business and professional field covered by its title.

THE QUESTION DEPARTMENT

Cost of Street Paving.

Will you kindly let me know where I can obtain information as to prices being paid for various forms of street paving?
W. H. T., Perth Amboy, N. J.

MUNICIPAL ENGINEERING is the best source of information on this subject. The following prices at which contracts for paving have been let this year are taken from the many published in the monthly numbers because they are fairly comparable unit prices:

Asphalt, per square yard: Huntsville, Ala., $1.82; Little Rock, Ark., $2.20; Muskogee, Okla., $2.03; Knoxville, Tenn., $1.78 to $2.66; Washington, D. C., $1.455; Harrisburg, Pa., $1.68; Philadelphia, Pa., $1.94 to $3.24; Glens Falls, N. Y., $2.08; Evansville, Ind., $1.86; Saginaw, Mich., $1.53 to $1.70; Chicago, Ill., $1.90 to $1.99; Springfield, Ill., $1.49; Kansas City, Mo., $1.70 to $2.18.

Asphalt block, per square yard: Washington, D. C., $1.65 to $2.00; New York, N. Y., $1.77 to $1.84.

Macadam treated or laid with tar or asphalt binder, per square yard: Dallas, Tex., $2.30; Knoxville, Tenn., $2.70; Utica, N. Y., $1.40 to $1.93; Piqua, O., $0.90; Milwaukee, Wis., $2.18; Stockton, Cal., $1,665. Camden, N. J., $2.03 per linear foot of road.

Macadam, per linear foot of road except as otherwise noted: Culpepper, Va., 83 to 84 cents; Hampton, Va., $1.26; various counties in Maryland, 50 cents to $2.13, mostly between $1.46 and $1.69, and one at 92 cents a square yard; Newton, N. J., $1.19; Flemington, N. J., $1.26; Hartford, Conn., $1.67; Kansas City, Mo., 52 cents; Sacramento, Cal., 93 cents to $1.28; Aberdeen, Wash., $1.745 a cubic yard.

Gravel roads, per linear foot: In Indiana, 21 to 48 cents; in Alabama, 22 to 64 cents.

Brick road, per linear foot of road: Marietta, O., $2.93; Fairmount, O., $2.33; Beaver, Pa., $3.37.

Brick pavement, per square yard: Bessemer, Ala., $1.64; Gainesville, Ga., $1.84; Knoxville, Tenn., $2.75 to $3.63; Washington, D. C., $1.21; Windber, Pa., $1.22; Asbury Park, N. J., $2.29; Corning, N. Y., $3.11; Utica, N. Y., $2.40; Catskill, N. Y., $2.29; Springfield, Ill., $1.33 to $1.46; Bloomington, Ill., $1.81; Oak Park, Ill., $2.36; Lawrenceville, Ill., $1.34; East St. Louis, Ill., $1.45; Chicago, Ill., $2.12; Davenport, Ia., $1.45 to $1.50; Council Bluffs, Ia., $2.075; Shenandoah, Ia., $1.80; Des Moines, Ia., $1.81; Marengo, Ia., $1.64; Bedford, Ia., $1.80; Cresco, Ia., $1.74; Fond du Lac, Wis., $1.32; Moorhead, Minn., $2.52; Kansas City, Mo., $1.49 to $1.74; Trenton, Mo., $1.95; Grand Island, Neb., $2.08; Wichita, Kan., $1.67; Salina, Kan., $1.71; Muskogee, Okla., $1.94.

Creosoted wood block pavement, per square yard: Philadelphia, Pa., $3.16 to $3.72; Detroit, Mich., $1.75 to $1.96; Chicago, Ill., $2.89; Shenandoah, Ia., $2.65; Moorhead, Minn., $2.59.

Granite block: Philadelphia, Pa., $3.00 to $3.96 per square yard.

Sandstone block: Kansas City, Mo., $3.10 per square yard.

Cement paving, per square yard: Knoxville, Tenn., $2.83; Roanoke, Va., $1.60; Mason City, Ia., $1.19 to $1.26; Kansas City, Mo., alleys, 73 cents to $1.10; Portland, Ore., $1.50; Walla Walla, Wash., $2.83.

Cement sidewalks, per square foot: Little Rock, Ark., 9.75 cents; Anniston, Ala., 9.74; Millburn, N. J., 15.75; Syracuse, N. Y., 8.1; Lawrence, Mass., 14.4; Fall River, Mass., 14.4; Westmount, Que., 25; Cobourg, Ont., 7.95; Clinton, Ind., 6.5; Vincennes, Ind., 8.625; Mora, Minn., 8; St. Charles, Mo., 25; Bremerton, Wash., 13 cents per square foot.

Boulevard: Wilmington, Cal., 66 cents per linear foot for construction; Boston, Mass., 4 cents per square yard for chloride of calcium treatment for 9 months.

It should be noted that no attenion is paid in this collection of figures to the differences in character of specifications and inclusion and exclusion of appurtenances and therefore comparisons must not be made too minutely. They serve, however, to give a general idea of the variations in prices of the different kinds of pavement in different parts of the country.

Asphalt in Oklahoma towns with 5-inch concrete base and 2½ to 3-inch binder and top costs in Tulsa, $2.23, with 10 years' guaranty and $2.10 to $2.15 with 5 years guaranty; Enid, $2.25 to $2.29 with 10 years guaranty and 6-inch base; Muskogee, $1.94 to $2.06; El Reno, $2.29, with 10 years guaranty. In these towns cement costs $1.49 to $1.67 a barrel; sand, 90 cents to $1.25 a cubic yard; broken stone, $1.25 to $1.85 a cubic yard; excavation and embankment, 28 to 39 cents a cubic yard, paid both ways in El Reno.

In Des Moines, Iowa, prices for paving

in 1908 were as follows: Brick, per square yard, cost $1.29 to $2.30, the average being $2.03 when 5 cents a square yard for the incidental expenses is added. Asphalt, per square yard, cost $2.00 to $2.15, averaging $2.08 after 3 cents for incidental expenses is added. creosoted wood blocks cost $2.39 to $2.64 a square yard, averaging $2.67 after 7 cents is added for incidentals. Oiled roads, laid by day labor, cost 80 cents a square yard. Curbing cost 15 to 42 cents a linear foot, averaging 40 cents, including 6 cents for incidentals. Combined curb and gutter cost 50½ to 56 cents a linear foot, averaging 62 cents, after adding 9 cents for incidentals. Brick sidewalks cost 8½ cents a square foot or, with incidentals, 9.3 cents. Cement sidewalks cost 10¾ cents, or, with incidentals, 11.6 cents a square foot.

Some deductions from a series of tables presented to the Illinois Society of Engineers and Surveyors by its committee on roads and pavements will be found elsewhere in this number. The full report will be published in the annual publication of the society.

Specifications for Cement and Stone Sidewalks, Curbs and Gutters.

I am very anxious to get the best specifications for curb and gutter and sidewalk work, both in stone and cement, that I possibly can.

R. J. H., Poughkeepsie, N. Y.

The best specifications for cement sidewalk, curb and gutter will be found in the Hand Book for Cement Users ($3). It has a number of sets of specifications from cities in different parts of the country from which can be selected those which will be most suitable to the local conditions. Specifications for both stone and cement in sidewalk, curb and gutter work have been given in MUNICIPAL ENGINEERING, and reference may be made to the following articles among the many: Vol. xxxvi, p. 30; vol. xxxv, pp. 103, 186, 389, curb and gutter; vol. xxxiii, p. 184; vol. xxxii, pp. 24, 25, 177, 179, 81; vol. xxxi, p. 104, full specifications for sidewalks, p. 25, curb and gutter specifications; vol. xxx, p. 8; vol. xxix, p. 81, article on granitoid curb and gutter; vol. xxviii, p. 89, stone and brick sidewalks.

Specifications for stone curbing vary materially as to kind of stone, the particular kind being most frequently specified with a statement of the standard of quality. The setting of curb also varies according to local conditions and also according to local preferences or customs. The following gives some idea of these variations, from which the standards may be selected for any particular locality.

Boston uses granite curb largely. It is set in a trench 18 inches wide and 24 inches deep, the lower 4 inches being refilled with gravel thoroughly rammed upon a foundation made solid by excavation and gravel refilling if not already so. The stones, 20 inches deep, are laid with solid bearing throughout, to exact line, with close joints, and the refilling each side is of gravel rammed in 4-inch layers. Joints are pointed front and back with cement mortar. The specifications are probably justified by the conditions of climate and travel.

New York City requires best North River blue stone, 3 feet or more in length, matched throughout, 5 inches thick, and 20 inches deep. The top is cut with 1 inch bevel and the front cut smooth and to a fair line of 14 inches depth, ends squared from top to bottom to make close, even joints and front laid in fair and unbroken line. The curb is back-filled with at least one foot of clean gritty earth free from clay and loam.

Rochester, N. Y., requires best hard Medina sandstone of uniform color, 3 feet or more long, matched width, 18 inches depth. Top and arris are axed to smooth surface with ¼-inch bevel on top, face dressed true, not varying more than ¼ inch from true plane for 10 inches down from the top. Back is point dressed 3 inches down and remainder hammer dressed. Bottom is roughed off parallel to top, must be full width and not more than 6 inches shorter than top. Faces are parallel and true to line or curve to which they are laid. Ends are truly squared and dressed 12 inches down from top so that joints so far down shall not exceed ¼ inch. Three-inch tile drain is laid in coarse gravel 2½ feet below the top and under the foundation of the curb and is connected with surface sewers. The foundation is concrete 6 inches thick and 18 inches wide, carried up in front of the curb to the pavement foundation, and on the back 6 inches thick to 6 inches below top. Joints for 12 inches down are pointed and neatly tucked and surplus mortar cleaned off. This is one of the most elaborate specifications in use.

Troy, N. Y., requires best North River blue stone as per sample, 4 feet or more by 5 inches by 20 inches and similar provisions to those at Rochester, but not so detailed.

Jamestown, N. Y., requires sound, durable stone 6 inches by 22 inches by 4 feet or more, full depth and full thickness at bottom, dressed to true surface with ⅜-inch bevel on top, and 10 inches on face by straight edge, with ends cut at right angles for ⅛-inch joint; top and face chisel dressed and back pitched off to line, and bunches on face below gutter cut off.

Baltimore, Md., requires first-class Woodstock or Richmond granite or equal, free from defects, as seams, sap, scale or discoloration, 6 inches by 18 inches by 8 feet or more and straight, face bush hammered 6 inches and dressed 14 inches deep, top bush dressed, backs pointed down 4 inches, with draft on edge, joints dressed square to the top for full depth, grouted and pointed with cement.

SPECIFICATIONS FOR SETTING STONE CURB.

City	Thickness in.	Depth, in.	Minimum Length ft.	Face Dressed in.	Back Dressed in.	Top Bevel in.	Joint.	Kind of Foundation and Amount.
Boston, Mass.....	...	20	.....	..	.....	..	*a*Tight	Gravel, 4 in.
New York, N. Y...	5	20	3	14	.....	1	Close	.....
Rochester, N. Y...	...	18	3	10	3	¼	*a*¼ in.	Conc., 6x18 in.
Troy N. Y.....	6	20	4	14	3	¼	¼ in.	Conc., 6x12 in.
Jamestown, N. Y..	6	22	4	10	Pitch	⅜	⅛ in.	Rammed
Baltimore, Md....	6	18	8	14	4	0	*a*Sq.	.....
Pittsburg, Pa.....	6	24	.....	12	3	0	.....	Stone, 12 in.
Erie, Pa.....	6	22	4	12	6	0	⅛ in.	Sand, 6 in.
Cincinnati, O., A...	6	21	5	13	4	0	⅛ in.	Gravel, 2 in.
Cincinnati, O. B...	5	21	3	12	3	0	¼ in.	Gravel, 2 in.
Akron, O.....	6	18	3	12	4	*½	*a*Tight	Gravel or cinders, 6 in.
Dayton, O.....4 or 5	.....	3½	10	.....	⅜	⅛ in.	Gravel or b. s., 6 in.
Detroit, Mich.....4, 5, 6	18	3, 4	12, 15	3	†¼	Close	Sand
Anderson, Ind....	4, 5	21, 24	4, 5	12	3	‡	Close	Gravel, 6 in.
Auburn, Ind.....4, 5, 6	18 to 14	6	10	2	1	*a*¼ in.	Gravel, 4 in.
Dunkirk, Ind.....	4	24	4	8	.....	...	*a*⅛ in.	Sand, 4 in.
Garrett, Ind.....4, 5, 6	18 to 24	6	10	2	1	*a*¼ in.	Gravel, 4 in.
Indianapolis, Ind..	5	24	5	12	4	†	⅛ in.	Gravel or b. s., 6 in.
Chicago, Ill.....	5	36	4	12	3	..	Close	12x8x6 in. stones
Milwaukee, Wis...	4	.....	.....	..	3	..	Close	Sand, 6 in.
St. Louis, Mo.....	4, 6	22, 24	3, 4½	16	4	..	Close	.....
Omaha, Neb.....	5	20	3	10	6	½	Close	Sand, 6 in.
Denver, Col.....4, 5, 6	15 to 20	5	12	6	*b*⅓	Close	Conc., 6 in.
Toronto, Ont.....	...	.....	4	12	4	½	*a*¼ in.	Gravel, 6 in.

SPECIFICATIONS FOR SETTING STONE CURB—Continued.

City	Kind of Backing and Amount.	Kind of Stone.
Boston, Mass.....Gravel, 6 in.		Granite
New York, N. Y...Earth, 1 ft.		Blue stone
Rochester, N. Y...Concrete, 6 in.		Medina
Troy, N. Y.....Concrete, 6 in.		Blue stone
Jamestown, N. Y..Rammed		Sound, durable
Baltimore, Md.....		Granite
Pittsburg, Pa.....Stone and clay, 6 in.		.....
Erie, Pa.....Gravel, 6 in.		Sandstone
Cincinnati, O., A.....		Flat Rock, Xenia, Dayton
Cincinnati, O., B.....		Flat Rock, Xenia, Dayton
Akron, O.....Gravel or cinders, 6 in.		Limestone
Dayton, O.....Gravel or b. s., 6 in.		Granite, Medina, blue stone, Elyria, Fulton, Berlin Heights, Berea, Hammond
Detroit, Mich.....Sand		Sandstone, oolitic or stratified limestone
Anderson, Ind.....Rammed		Berea or Leesville sandstone; oolitic or stratified limestone
Auburn, Ind.....Gravel, 4 in.		Berea sandstone
Dunkirk, Ind.....Sand, 4 in.		Berea or Leesville sandstone
Garrett, Ind.....Gravel, 4 in.		Granite, blue oolitic, stratified limestone, Berea sandstone
Indianapolis, Ind..Gravel or b. s., 6 in.		Limestone
Chicago, Ill.....Earth, 12 in.		Hard limestone
Milwaukee, Wis...Sand or gravel		Limestone
St. Louis, Mo.....		.....
Omaha, Neb.....Sand, 6 in.		Granite, Buckhorn, Lyons, Arkins sandstone
Denver, Col.....Concrete, 6 in.		Credit Valley stone
Toronto, Ont.....Gravel, 6 in.		

*½ in. circle. †1¼ in. circle. ‡1½ in. circle. *a*Cemented. *b*½ in. circle.

Pittsburg, Pa., has 6 by 24 inch curb dressed 12 inches on face and 3 inches on back, set in broken stone 18 inches by 30 inches, with bottom foundation 3 feet below the top of curb, with 6 inches of clay 12 inches down from top on the back.

These examples give a general idea of the variations in specifications. The accompanying table shows the variations in dimensions in cities of various sizes in various parts of the country:

Who Sells Gilsonite?

Can you tell me who sells gilsonite?

ASPHALT, ————, Ind.

John S. Lamson & Bro., 84 William St., can give you information as to the supply of gilsonite, its price, etc.

Owners of Rock Asphalt Mines.

Will you advise us of the names of some firms who own rock asphalt mines and who furnish rock asphalt and construct rock asphalt pavements?

J. S. W., Kansas, City, Mo.

The users of rock asphalt in pavements who own mines in the United States are the Shelby-Downard Asphalt Co., Ardmore, Okla., and the Wadsworth Stone and Paving Co., Pittsburg, Pa. Foreign rock asphalts and asphalt mastics can be obtained of Gabriel & Schall, 205 Pearl St., New York, N. Y.

Court Decisions Regarding Defective Side-Walk Gratings.

Will you kindly give me reference to cases determined by the courts of last resort of the various states outside of Michigan in actions for personal injuries sustained by reason of defective gratings in sidewalks?

E. E. H., City Attorney, Mich.

The following decisions on this and closely related occurrences, have been reported in MUNICIPAL ENGINEERING:

Vol. xxxvii, p. 117: City was not negligent in permitting stairway in sidewalk with railings on outside. Elam vs. City of Mt. Sterling, N. C., 117 S. W., 250.

Vol. xxxvi, p. 252: Maintenance by city of slippery iron cover on coal hole in sidewalk is actionable negligence. Smith vs. City of Tacoma, Wash., 98 P., 91.

Vol. xxiv, p 38: Tenant, not landlord, is liable for use of cellar opening in sidewalk with iron doors and without railing prescribed by ordinance. Morrison vs. McAvoy, et al., 70 P., (Cal.) 626.

Vol. xxiii, p. 263: Property owner must maintain cellar door on sidewalk reasonably safe for use. Snader vs. Murphy, 19 Pa. Super. Ct. 35. Also city may authorize space under sidewalk, but not sidewalks themselves for private purposes. Herneck vs. Grosse, 99 Ill., App. 441.

Vol. xxi: City is guilty of negligence for allowing coal hole in sidewalk to be propped open several months. Stege vs. City of Milwaukee, Wis., N. W. Rep., 161. Also, city is liable for injury by foot slipping through hole in grating in sidewalk. City of Henderson, K., vs. Reed, 62 S. W. Rep., 1039.

Vol. xx, p. 351. City is liable for injury at deep areaway on busy street insufficiently guarded for a long time. Donnelly vs. City of Rochester, N. Y., 59 N. E. Rep., 989.

Vol. v, p. 232: Property owner cannot escape liability for cellarway, trap-door or scuttle in sidewalk by abandonment and city can recover from him for damages paid to person injured. City of Wabasha, Minn., vs. Southworth, Sup. Ct., 55 N. W. Rep., 818.

Concrete for Street Crossings—Makers of Sewer Rods.

Could you give me the exact proportion for mixing concrete for street-crossings and do you think it advisable to put in such crossings where you have to contend with heavy frost? I would like to hear from parties that have some experience in this work. Would it be also advisable that there should be joints same as in a sidewalk, or a continuous crossing, without joints? We are contemplating making a start with such crossings. Could you give me also the names of firms that are selling or making what you call sewer rods, as we also intend to purchase a certain amount?

J. S., Street Commissioner, ——, Wis.

The proportions for the concrete for street crossings do not differ from those for cement walks. The crossings are made deeper and the wearing surface is made thicker, in proportion to the amount of traffic and the depth of the frost. It is probably better to joint the crossings every six or eight feet, in the same way that sidewalks are jointed, especially if the ends abut against curbs.

Full specifications will be found in the "Handbook for Cement Users," ($3). They provide for 6 to 10 inches excavation according to character of soil, the lower four inches in the latter case to be refilled with well compacted cinders, gravel and broken stone, a first 4-inch layer of 1 part Portland cement and 4 feet clean gravel or broken stone, 2 to 1 and a top 2-inch layer of 1 Portland cement to 1 clean, sharp sand or crushed granite of pea size and less, divided into 5 by 5-foot blocks, with keystone blocks over underground pipes or sewers. V-shaped grooves 1 inch wide and 3-16-inch deep, each 4 inches may be used if deemed necessary.

Our readers are invited to give their proportions and methods of construction and the provisions made when the frost comes out of the ground and makes deep mud in the roadway, such as often occurs in the unimproved streets of villages and small cities.

Sewer rods, of special form, are sold by The Contractors' Tool Co., Philadelphia, Pa., Harold L. Bond, Boston, Mass., The F. Bissell Co., Toledo, O. An ordinary jointed rod with screw joints can be made of short pieces of steel or pipe by a plumber or steel-worker, provided with dies for cutting the threads on the sleeves

and on the ends of the sections of rod. The pieces must be short enough to be handled easily in any manhole.

Establishing Grades for Streets, Sidewalks and Curbs.

Will you please inform me through the "Question Department" from what book or books I can procure the most satisfactory and practical information relating to establishing grades for streets, sidewalks and curbs. This is a hilly town, and the streets were laid out years ago, and they strike the hills at every conceivable angle. Any book describing good practice elsewhere on grades and cross-sections of hillside streets will be very valuable to me.

I. B. D., City Engineer, ———, Tex.

Some hints may be gathered from articles in this number of MUNICIPAL ENGINEERING. Other articles may be found in vol. xxxv, p. 105, xxxii, p. 389, and xxxiv, p. 366, the latter giving references to a number of previous articles from various sources on the subject.

This is a subject which has troubled many of our readers, and consequently MUNICIPAL ENGINEERING has in its volumes more detail upon it than can be found anywhere else. If the back volumes are not at hand, more detailed references will be furnished, and the separate monthly numbers can probably be supplied.

There is a short discussion of the subject in Byrne's "Highway Construction" ($5), and a little more extended one in Baker's "Roads and Pavements" ($5).

Concrete Lamp Posts.

Can you give me any information concerning concrete lamp posts, particularly for use with tungsten electric lamps? The iron standards would cost about $30.00 delivered here, and it ought to be possible to make satisfactory reinforced concrete posts, of an attractive pattern, at considerable less expense.

Do you know of any concrete posts in use for this purpose, and whether or not they have been satisfactory? Any information that you can give will be greatly appreciated, as a good many citizens of Greeley are desirous of installing a system of side lights instead of the overhead center arc system at present in use.

J. L. B. Greeley, Colo.

Concrete lamp posts are entirely practicable and have been used in many places. The simplest form is a reinforced concrete post or pole with a suspending bracket for the lamp, either projecting from the side of the post or from the top, in which case it might also be of reinforced concrete, made in one piece with the post or a more or less ornamental curved bracket rising from the top of the post and curving over to the point of attachment of the hanging lamp. Lamps are also set directly on the top of the post or one or more clusters of lights are hung about the post either about the top or lower down.

These forms are shown in illustrations from foreign countries and in designs for such work in this country. The foreign work, of which photographs are at hand, is very plain, but some of the designs for new work are very elaborate. The Chicago Park Commission having charge of Lincoln Park held a competition last year and awarded prizes for the best designs for concrete posts for lights.

The most satisfactory method of serving the lights is by underground wires which come up through hollows or grooves in the poles for attachment to the lamp, but properly reinforced poles will carry overhead wires as well as the lamps. It will, however, be more difficult to make handsome designs for poles for the double service.

The first expense of molds for making the poles will depend upon the price paid for the designs and their elaboration. If there are but few poles to be made, highly ornamental poles might be quite expensive, but the expense for molds is paid but once and the cost of good designs is therefore but a trifle if distributed over a large number of poles, and is fully justified, particularly for city lighting in these days of the "city beautiful idea." There is considerable leeway in the price mentioned for this expense.

Pictures of good designs for columns adaptable to this use, and of electroliers will be found in the advertising literature of the larger cement companies, in the publications of the Association of American Cement Manufacturers, and the results of the Chicago competition can probably be obtained from the Lincoln Park Commission. Some of the designs for metal poles shown in the article on "Ornamental Street Lighting" in MUNICIPAL ENGINEERING, vol. xxxiii, p. 385, may give ideas for concrete pole designs.

Concrete for Furnace Under Evaporating Pans.

I reside in a maple sugar district, and to handle our product successfully we must purchase evaporators at a high price.

The question has come to us can we construct concrete furnaces which will stand the heat? The pans will of course be iron. The furnace will be lined with brick and the heat against the walls will not be great. We can handle the matter of forms, proportions, reinforcements and everything of that sort if we can feel safe in regard to heat.

W. H. W., Bellville, O.

There should be no difficulty in using concrete for a furnace under evaporating pans, especially if the furnace is lined with some sort of refractory brick. The temperature in such a furnace is never excessive, especially if vacuum pans are used, and concrete, properly made and placed, will stand heat as well as or better than common brick. Some attention must be paid to the expansion and contraction of the walls under the changes in temperature by providing joints or loose connections at the corners of the structure so that the concrete itself will not crack. Concrete is successfully used for chimneys and fireplaces in more or

less constant use and has successfully stood the great heat of conflagrations for short periods of time. With the brick lining to take the wear of the handling of the furnace and to relieve the concrete of the direct action of the flames there can be no question of its adaptability to the situation.

Reinforced Concrete Pipe Under Pressure.

At an early date I shall face the problem of constructing a considerable section of pressure pipe for the conveyance of water in an irrigation project. I am investigating particularly reinforced concrete, and am trying to learn as fully as possible, where such pipe has been constructed, and more particularly where it is being constructed at present, in order that I may gather the most recent data upon the subject. A friend has referred me to you as being well posted on this head, and has suggested that I write to you. Any hints that you may give me will be most sincerely appreciated.

I have seen in the Transactions of the American Society of Civil Engineers that such pipes had been undertaken by the board of water works of New York City. As I recall at present two pipes of considerable size were contemplated by the board. Are you aware whether or not these pipes were completed? I have also studied the pipes constructed in connection with the U. S. reclamation work in Arizona, and have had my attention called to proposed works in Los Angeles. Are you aware whether or not work is now in progress in the latter place?

Z. N. V., Boise, Ida.

Reinforced concrete pressure pipe is proposed and under construction on several irrigation projects of the U. S. Reclamation service and is proposed for about 1.2 miles on the Los Angeles aqueduct as well as for two inverted siphons. Work is well under way on the Los Angeles aqueduct, but the pipe referred to has not yet been completed.

The New York work referred to is under construction and is illustrated in the July and August numbers of MUNICIPAL ENGINEERING. There will be 14 miles of concrete-lined tunnel laid on the hydraulic gradient, 15 miles of concrete-lined tunnel under pressure, being below the hydraulic gradient, 37 miles of cut-and-cover aqueduct of reinforced concrete covered with earth, and 16 miles of steel pipe line. The reinforced concrete aqueduct is probably never under any material pressure.

The Indianapolis Water Company has a reinforced concrete gravity conduit which was described in vol. xxviii, p. 328.

Some years ago Newark, N. J., constructed a twin reinforced concrete conduit, each channel being 5 feet in diameter, part of which may be subjected to 45 feet head, and part of which has been tested successfully to 35 pounds pressure. The conduit is described in vol. xxv, p. 364.

The Salt River power canal in Nevada, mentioned in vol. xxxii, p. 394, has an inverted siphon 5 ft. 3 in. in diameter and over 500 feet long under 85 feet head and a half mile under 30 feet head.

Among the Reclamation service projects of which information is at hand, may be mentioned the Buford-Trenton project in North Dakota with a 4-foot conduit under 60 feet head, which also has some short flumes and sluice ways of reinforced concrete on reinforced concrete supports.

The Sun River project near Great Falls, Mont., has about 1,600 feet of reinforced concrete inverted siphon 5 ft. 1½ inches in diameter under head of about 48 feet.

The Belle Fourche project, South Dakota, has a 5-foot reinforced concrete inverted siphon 3,570 feet long, 5 feet in diameter and under a maximum head of about 65 feet, also two short inverted siphons of 6 and 8 feet diameters under 15 and 45 feet head, respectively.

Tests of reinforced concrete pipe have showed their ability to carry 35 pounds pressure without leakage, but that 40 pounds produced some seepage through the concrete of the pipe. This could be reduced by proper waterproofing treatment.

Quinton's report for the Reclamation Service, "Water Supply and Irrigation, Paper No. 143," showed results not far different.

Recent tests by Supervising Engineer E. G. Hopson, of the Portland, Me., office of the Reclamation Service, are reported to be satisfactory and to have confirmed the purpose to use reinforced concrete pressure pipe on the Malheur and Umatilla projects.

The only failure of a reinforced concrete conduit which has been reported is that of the Richmond, Va., water works which was designed to carry 10 pounds pressure and showed tendencies to crack under 9 pounds test pressure. The conduit is 5 feet 2 inches wide and 5 feet 8 inches high with a very flat curve on the bottom. It was constructed by laying the invest first, running it 100 feet or so ahead of the arch, rough surfaces and projecting wire mesh being left to make the junction. This junction was evidently not well made, as under the test pressure the upper arch tended to push outward along it, settling back to place when the pressure was removed. Poor concrete, inadequate bond of the reinforcement, insufficient tamping and consequent defective joining of invert and arch are assigned as the causes of failure.

Within the limit of the maximum pressure above stated, therefore, it may be confidently stated that reinforced concrete pipe properly constructed with reference to its strength under the head to which it is to be subjected and its water tightness may be successfully used for conveying water.

Form for Keeping Meter Repair Records.

We would thank you to give us some information regarding a convenient blank form for keeping a record of repair work done on meters. Possibly you have some

blank forms available that you could send us a copy of. W. J. S., ——, Ill.

Can any of our readers supply the desired form? MUNICIPAL ENGINEERING will publish any that may be received, with due credit to the author.

Articles on Effects of Acids and Alkalies on Reinforced Concrete.

Did an article appear in your paper some time ago, of the effects of acids and sulphur water on reinforced concrete?

BEN K. FINCH, City Engineer,
Wilkes-Barre, Pa.

Most of the articles on deterioration of concrete which have appeared in MUNICIPAL ENGINEERING have been upon the action of alkalies upon concrete. Perhaps the article on "Destruction of Concrete by Alkali," vol. xxxvii, p 12, August, 1909, is the best summary as yet of the reasons for the observed deterioration and the methods of preventing it. The principles there stated may be extended to other materials which act upon the ingredients of cement and concrete in other ways.

There is no question that any substance, acid or alkali, which will act upon the materials which are contained in the concrete will cause deterioration if they are brought together. There has been one observation of the destruction of a concrete culvert by strong acid discharge from a factory. There has been one unauthenticated report of injury of concrete by stale sewage. There has been one case of concrete sewers seriously injured by alkali water in the soil. There have been other cases of concrete drains similarly affected. The principal remedy suggested in the article above referred to is to make the concrete impervious.

The following are titles of articles which appeared in a single volume of MUNICIPAL ENGINEERING upon this subject, namely, vol. xxxv: "Effect of Salt and Alkali on Concrete," p. 385; "Effect of Alkali Soils and Water on Concrete," p. 317; "Durability of Cement and Concrete in Sewers," p. 114; "Concrete Sewer Pipe," p. 102; "Concrete and Brick for Sewers," p. 178; "Salt and Sea Water for Mixing Concrete," with a number of references to earlier articles, p. 381.

Books on Sanitation and Water Supply.

Will you kindly advise me regarding some books on sanitation and water supply. I am anxious to get hold of books concerning the latest practice along these lines, and in particular those books relating to the sanitation and water supply of isolated places, such as farm houses and small towns.

Any other suggestions or data that you may furnish will be very acceptable.

W. C. DAVIDSON, Webb City, Mo.

Among the books that will be found valuable in the consideration of the special subject referred to are Starbuck's "Modern Plumbing Illustrated" ($4); Coleman's "Sanitary House Drainage" ($2); Waring's "How to Drain a House" ($1.25); Gerhard's "House Drainage and Plumbing (50 cents). These have chapters specially adapted to isolated houses and institutions, and while two of them are not new books, they all describe standard methods.

Turneaure and Russell's "Public Water Supplies" ($5) and Moore's "Sanitary Engineering" ($14) are the latest and best in their respective lines and cover all phases of their subjects, with less detail regarding the smaller projects.

Depreciation and Water Rates.

I would like to get hold of some copies of your magazine that will furnish information on how depreciation is figured on a water works plant for town of 4,500 population. I want information on subject of depreciation to make an estimate of the value of a 20-year-old plant, the estimate to be used in fixing water rates and hydrant rentals for town. I would like to get a copy of a report by Kiersted, entitled, "Valuation of Water Works Property." E. H., ————, Mo.

Reference may be made to MUNICIPAL ENGINEERING, vol. xxxvii, p. 35, for reference to several papers on the subject of depreciation in water works. The paper by Leonard Metcalf in the *Journal of the New England Water-Works Association*, there referred to, has detailed discussions of the various items that must be considered in estimating the value of a water-works plant and determining water rates. A brief resume of the paper will be found in MUNICIPAL ENGINEERING, vol. xxxvi, p. 29. In vol. xxxvi, p. 247, is a proposed form of contract with a water-works company which gets at the subject in somewhat different manner. In vol. xxviii are articles on meter rates on p. 446, and on fair water rates on p. 464. In vol. xxxi, p. 135, is an article on the value of a water-works. In vol. xxxv, p. 12, is an article giving the rates charged in many cities; p. 73 has an article showing the basis for fixing water rates and rentals. The basis for fixing rates at Cedar Rapids, Iowa, is stated in vol. xx, p. 346, and the allowance for depreciation is definitely stated. A method of determining an equitable hydrant rental is given in vol. xxiv, p. 182, and is discussed editorially on p. 189. The Indianapolis schedule of water rates is given on p. 195 of the same number.

A detailed examination of the condition of a plant is the best method of determining its value. An allowance of a percentage for depreciation from the original cost of the plant is always an approximation only and may not be a very close approximation. An estimate from inspection of the value of the plant as compared with a new one, if made by an expert, will be nearer the true value, and then, if it is considered desirable to make allowance for differences in cost of materials and labor between the date of construction and the date of inspection, this allowance can be made independently and therefore more accurately. The same

will be true of any other allowances which the local conditions may warrant.

Restriction and Removal of Dangerous Buildings within Fire Limits.

I will be pleased to have you refer me to some city that has an ordinance which especially provides for the regulation of the construction, erection, maintenance and demolition of buildings within specified limits.

The growth of a city demands a strict regulation of buildings, but the best method of handling the "shack question" seems to be a hard one to decide upon, as each city seems to have a method more or less of its own.

I have been informed that the city of Cincinnati passed an ordinance providing that all wooden buildings within certain limits had to be torn down within a certain specified time. Can you give me any information relative to its building code concerning this phase of it? Any information you can give me along the lines suggested will be appreciated. In short, I desire to know the best method of getting rid of wooden buildings in the business districts, and especially buildings requiring considerable repair.

T. L. M., City Attorney, ——, Wash.

The building ordinance of Cincinnati, passed May 11, 1909, does not contain the provision referred to. It is a comprehensive modern ordinance covering nearly all the subjects covered by similar ordinances in other cities. It permits more wooden structures than the ordinances of other cities. Sec. 3 of Chap. 1 of Title V reads as follows:

No frame or wood structure shall be erected within the fire limits, except as follows:

(a) Temporary building one (1) story in height, for the use of builders within the limits of lots whereon buildings are in course of erection or adjoining vacant lots, upon the permit of the Commissioner of Buildings.

(b) Temporary structures such as platforms, stands, election booths and circus tents.

(c) Buildings not exceeding twelve (12) feet in height and having walls and roofs covered externally with incombustible material.

(d) Privies and sheds not exceeding ten (10) feet in height and not over one hundred (100) square feet in area.

(e) Piazzas or balconies of wood, which do not exceed eight (8) feet in width and which do not extend more than three (3) feet above the second floor beams.

(f) Bay windows of wood covered with incombustible material, if otherwise in accordance with this ordinance.

(g) Fences not over six (6) feet high.

(h) Isolated grain elevators, ice houses and wharf houses covered externally with incombustible material, and coal tipples.

(i) Lumber piles not over fifteen (15) feet high.

All buildings hereafter erected within the fire limits must have the exterior walls built of brick or other incombustible material and the roofs covered with incombustible roofs, and must in other respects be in accordance with the requirements of this ordinance.

Many cities have much more stringent restrictions of new construction within fire limits, but the detailed descriptions of permissible buildings usually show the pressure brought to bear upon the council to retain certain usual structures in the locality or to permit classes of structures desired by certain local interests.

With reference to the removal of buildings existing before the fire limits were extended to include them, the powers of the city are limited by its charter provisions. They ordinarily do not extend beyond the condemnation and removal of dangerous buildings. The Cincinnati ordinance is probably as comprehensive as any. Sec. 1 of Chap. 2 of Title V of the building ordinance reads as follows:

Any building or buildings, or parts thereof, and any staging, elevator, stairway, fire escape, fence, billboard, awning, canopy or other structure or structures of whatsoever kind, that from any cause may now be or shall at any time hereafter become dangerous or unsafe, shall be made safe and secure or taken down and removed by the owner, lessee, occupant or person having charge thereof. The Commissioner of Buildings shall immediately, when advised of the dangerous or unsafe condition as aforesaid, make a record thereof upon the docket to be kept by him of unsafe buildings, and he shall thereupon serve the owner or some one of the owners, executors, administrators, agents, lessees, occupants or any other person or persons that may have a vested or contingent interest in the same, with a written or printed notice thereof, and shall also notify the Chief of the Fire Department and of Police, describing the premises or other structure as aforesaid deemed unsafe or dangerous and requiring the same to be made safe and secure or removed, as may be found necessary by the Commissioner. Said notice shall require the person served to immediately advise the Commissioner of Buildings whether he or they will or will not make secure or remove the unsafe structure, and he or they shall be allowed twenty-four (24) hours after the service of such notice in which to commence to secure or remove the same. If the party served refuses to make secure or remove the dangerous or unsafe structure, or if he does not commence to make secure or remove the same within twenty-four (24) hours, the Commissioner of Buildings shall, if in his opinion it shall be necessary, enter upon the premises with a sufficient force and make secure or remove the same, or such part thereof as may be necessary to make the premises safe, and the cost thereby incurred shall, upon the certificate of the Commissioner, be paid out of the City Treasury, through the City Auditor, from the funds and in the manner hereinafter provided for. And any expense so incurred shall be collected from the owner or owners, agent, lessee or occupant by action brought in the name of the city in a court of competent jurisdiction, to be instituted by the City Solicitor. The Commissioner shall also place a written notice on any dangerous or unsafe premises so as to warn the public thereof.

However, the title of Chapter 2 is "Prevention of Collapsing of Buildings," and the section quoted was apparently not constructed to apply to buildings dangerous only on account of the fire risk, although it may be applied to such buildings.

A similar ordinance in Indianapolis is still further restricted in application, the section beginning "Whenever any wall or other part of a burned or otherwise injured building is unsafe, or when any building or any part there of shall be un-

safe for the purpose for which it is intended or used," etc. The building inspector of Indianapolis, through the Board of Public Works, followed if necessary by proceedings in the police court, is able, however, to remove any really dangerous fire-traps or "shacks."

The city charters of Baltimore, Cleveland, St. Louis, San Francisco give similar powers.

Chicago can order such buildings torn down only when the damage to them by fire or otherwise has been 50 per cent. of their value, and other cities follow this lead.

Detroit, New Orleans, Toronto are restricted to the prevention of the erection of new buildings or the repair of old buildings within the fire limits. But a recent court decision, quoted in MUNICIPAL ENGINEERING this month in the department of "Municipal Matters in Court," states that such prohibition of repairs does not extend to such minor repairs as new window frames and the like.

The general charter law of Wisconsin provides for the definition and removal of nuisances in terms that will permit the inclusion of dangerous buildings, and it is probable that, where the statutes do not definitely limit the city's powers in this regard, ordinances ordering the removal of shacks can be based on a preamble giving a definition of nuisances that will include them.

The following ordinance, from Dubuque, Iowa, treats the dangerous buildings as nuisances:

Sec. 1. No person shall erect within the city of Dubuque, or cause to be erected, or shall maintain or permit or suffer to remain on their premises, any wall, structure or building which by reason of dilapidation, defects in its structure or other causes may be dangerous to life or property; and the City Council may by resolution order the same repaired or removed by the owner within such time as the City Council may prescribe; said resolution shall state the name of the owner or owners of such dangerous structure or building, in what the danger consists, and also a description of the property upon which the same is located.

Sec. 2. A written notice of the contemplated action of the City Council, together with a copy of the resolution, shall be served personally by the City Marshal or Chief of Police upon the owner or owners of the property upon which such structure or building is located, commanding them to appear before the City Council at a time named and show cause, if any they have, why said structure should not be declared a nuisance and removed. If the owner or owners are non-residents, such notice and a copy of the resolution should be served upon his or their agent, if one is in the city, and if no agent of said non-resident is known to be in the city, then said notice and copy of resolution may be posted on the premises by the City Marshal or Chief of Police and published in the official paper of the city for such a period as the City Council may deem proper and direct.

Sec. 3. Upon the hearing thereof, if the City Council find that said structure or building is dangerous, it may be declared a nuisance and order it abated or removed within such time as may be fixed by said Council.

Sec. 4. Upon such order being made by the City Council the City Marshal or Chief of Police shall immediately notify in writing the owner or agent of such structure or building so ordered abated, to have the same removed or abated. In case the owner or agent shall fail to comply with said notice within the time fixed, it shall be the duty of the City Marshal or Chief of Police to proceed forthwith to abate or remove said nuisance, and the expense of which shall be paid by the owner or agent, and may be collected of either by suit, and may be established as a lien upon the land upon which said structure or building is located.

If the laws of Washington will permit such procedure, this ordinance may be made to cover such cases by revising the procedure to conform to that prescribed in Washington, incidentally correcting its defective English construction.

The city of Washington, D. C., has a law governing the condemnation of unsanitary buildings which is very complete and has evidently been prepared by experts. It is possible that it could be used as a model for an ordinance on the subject of dangerous buildings.

Books on Estimating Quantities.

Can you send me a book on calculations adapted to this business, or the title and price and where to be got? I have a boy whom I wish to post along the lines such as how to calculate a wagon full of stone, and what constitutes 50 feet, such as length, breadth and thickness; also what a perch in wall and elsewhere must contain. T. M., St. Louis, Mo.

Perhaps Arthur's "Building Estimator" ($2.50) will serve the purpose. There are so many variations in value of the old measures, and the "customary" methods of measurement differ so much in different localities, that the custom of taking actual measurements from plans and structures, and giving the results in square feet or yards or cubic feet or yards, is each year becoming more thoroughly established. Mr. Arthur's book is made on this basis, and will not give much help in applying customary rules, nor are the results given in squares or perches or other measurements, except feet and yards, linear, square or cubic, as the case may be.

Have our readers any suggestions to make?

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Curb Specifications.

The following specifications for concrete, granite and blue stone curbs will be of interest in connection with the inquiry in the "Question Department" for curb specifications. They are from the specifications for the general improvement of Dover, Delaware, contracts for which will be let shortly, and are written and copyrighted by Geo. L. Watson, the chief engineer of the street and sewer commission of Dover.

CONCRETE CURB.

Concrete curb shall be laid wherever directed by the engineer in the following manner, wooden forms composed of two planks upon each side of the curb 2 inches by 9 inches by 16 feet no inches, shall be laid on edge, one to top of the other, each plank to be planed on the inner face and on edge so as to make the two edges absolutely parallel. The two ends and middle of bottom plank shall be set upon a wooden block firmly imbedded in the ground and 18 inches below the finished outside top line of the curb. The top plank shall be one-half inch higher than the top of the outside plank to give the curb the proper wash. These planks shall be set 6 inches apart, the inside of the outer planks exactly coinciding with the curb line as given by the engineer. They shall be held in place by driving 3x3x6-inch wooden stakes, spaced 4 feet between the centers, the top of each stake to terminate at top of upper planks. The stakes shall be held in position by braces 2x2 inches by such length as may in each case be required to hold the stake in its proper position. The inside of the planks shall be braced by wooden braces 2x2x6 inches which shall in every case be removed as the concrete is placed.

For curved curbs, the wooden planks shall consist of cypress boards ⅜ inch thick, planed on inner face and bent to the proper radius and held in place by as many stakes as above described as may be needed, or a patented steel form of approved design may be used.

After the wooden forms are properly set, the earth foundation to receive the concrete shall first be thoroughly rammed until its surface coincides with the bottom of the planks used to form the faces of the curb. Upon this shall be laid concrete in layers four to six inches thick tamped in place until the water and cement flushes to the surface of each layer, the layers to continue uniformly throughout the length of the section to be completed, until its top surface is within 2 inches of the top of the wooden forms. Place the iron frogs spacing them 5 feet between centers (except at curves where they shall be spaced two feet apart) and at exactly right angles to the face of the curb, the outer face being in contact with the wooden form. Into these steel frogs set the steel corner bar, drawing it well into position with a wooden mallet, care being observed to have the outer face of the corner bar coincide with the true line of the curb throughout.

Before driving the corner bar into position, place under it with a trowel a sufficient amount of the fine top mixture of the concrete to permit of the bar being thoroughly imbedded therein throughout. Cut the curb through transversely at the end of each steel corner bar with the proper tool, making a joint one-fourth inch in thickness; through the curb into this joint shall be run sufficient fine dry sand to entirely fill it, and the concrete carefully tamped up adjacent thereto. After the corner bar is properly set, fill up the balance of the curb with fine top mixture which must be worked well into place, particularly around the bar and complete to the end of each bar as soon as possible, and cut this finishing coat with the trowel through to sand joint in the concrete. After the concrete has set up sufficiently, the forms shall be carefully removed, so as not to disturb the concrete, which shall be immediately floated upon the outer face with a thin coat of mortar composed of one part cement, one and one-half parts sand and one-eighth part of lamp black.

The concrete comprising the body of the curb shall be composed of one part cement, two parts clean, sharp, dry sand, and five parts clean, broken stones which will pass a circular mesh screen one inch in diameter and be retained upon one 1½ inches in diameter. The concrete shall be well mixed in the manner described in these specifications and shall be a fairly

wet mixture. The top of finishing coat shall be mixed in a separate box and shall comprise one part of cement, one part clean, sharp, dry sand and one part clean granite screenings, 1-16 to ⅛ inch in size and ⅛ lamp black thoroughly mixed as the engineer directs.

As soon as the forms are removed and the finishing coat well set up, that earth shall be carefully tamped against the front and back of the curb until it reaches the top, so as to protect it from the sun and top shall be frequently sprinkled with water to prevent cracking. Should any damaged curbs be observed prior to the completion of the roadway, the whole section of curb, containing the damaged part shall be removed by the contractor and replaced by him at his expense to the satisfaction of the engineer. The outer face and top of each curb must present a smooth and neat appearance throughout.

Where concrete curb adjoins a concrete sidewalk, the space between the inner face of the curb and the outer line of the sidewalk shall be filled with granolithic pavement of the same quality as the section of sidewalk which it adjoins and be finished in the same manner and so as to make as good appearance as may be practicable in the judgment of the engineer.

If the sidewalk which adjoins the curb be composed of bricks the contractor shall relay the section of the sidewalk with bricks of the same quality as the balance of the sidewalk and join it in the best practicable manner. The cost of completing the above described sections of sidewalk shall be borne by the contractor up to a line 18 inches inside of the inner line of the curb and shall be included in the price named in the contract for building concrete curb.

GRANITE CURB.

Granite curb shall be furnished and laid where directed by the engineer. It shall be furnished in sections not less than 5 feet in length, shall be 5 inches in thickness on its upper face. The top face shall be cut and axed with a four cut hammer to a plane surface. The front face shall have a chisel draft ¾ inch wide at its upper edge in order that the arris may be straight and true. The remainder of the front face to a depth of 6 inches from the top shall be pointed to an approximately plane surface without depressions under a straight edge 4 feet in length exceeding ¼ inch in depth. The bevel between the top and front faces shall be at the rate of ⅞ inch to the foot.

The remainder of the front face to a depth of 11 inches from the top of the curb shall be free from projections which will interfere with laying suitable gutter against the curb with reasonably close joints.

The back shall be cut down at right angles to the top face to a depth of 3 inches.

The ends shall be squarely joined for the full width of the stone to a distance of 3 inches below the top face and thence below for a width of 1½ inches back from the front face to a point at least 7 inches below the top of the curb.

The quality of the stone and the cutting shall be satisfactory to the engineer.

The granite shall be good, close-grained, free from all defects; out of wind and 18 inches in depth. The bottom will be rough dressed, parallel with the top edge and the end joints shall butt for the entire depth of curb.

Corner curbs shall be furnished wherever required. They shall be in all respects the same as described above for straight curb, except that they shall be cut through to the true radius given by the engineer and shall be so cut that the full curve shall be formed by stones none of which shall be less than 4 feet 6 inches on its outer circumference.

The stones shall be set upon a foundation of crushed stones 4 inches in thickness and 12 inches wide and the curb well settled in place upon this foundation of stones by means of the paver's rammer with a wooden face. Each stone shall be set true to line and grade and out of wind and shall have the earth thoroughly tamped both sides of it. Any curb which may be disturbed or fractured during the building of the roadway shall be taken out and replaced in its proper position or substituted by a perfect curb by and at the expense of the contractor.

BLUE STONE CURB.

Blue stone curb shall be set wherever directed by the engineer. It shall be first class in all particulars without water grains. The stones shall have a uniform thickness of 5 inches and a uniform depth of 18 inches without outside or inside bumps of any kind. The top face shall be smoothly dressed or sawed to a level of one-half inch and no stone shall be less than 5 feet in length. The ends must butt for the entire depth of curb. They shall be set in all respects as described for setting granite curb. The price named for furnishing and setting each quality of curb named in these specifications shall include the furnishing of all materials, tools, plant and labor; the performance of all work necessary to complete the work in conformance with these specifications and the repaving and repairing of the sidewalks adjoining the curb in the manner elsewhere described herein.

El Reno Paving Is Good.

The city of El Reno, Okla., has embarked on a paving plan which has given rise to considerable criticism and ill feeling. Mayor LaBryer called in P. A. Bivins, a civil engineer of Toledo, O., to investigate, and he has made a detailed and exhaustive report. The questions of

method of obtaining the contract and its validity were not included as they are not engineering questions. The report covered in detail the estimates on which assessments of property were based and found only one error requiring reassessment for one street intersection. The pavement as staked out or as constructed conforms to the grades specified in the profiles. Estimates of earthwork are as close as two engineers working independently can estimate rough ground and assessments based on them are in general too low rather than too high. The work of the contractors, the Cleveland Trinidad Paving Co., so far as it has been done, is of high grade, concrete being better than specified, curb and gutter affected by the weather having been relaid and line and surface being kept in a workmanlike manner. The duties of the paving engineer, M. L. Latimer, have been performed with system and care and records are full and clear. The work of assistants in staking out and inspecting work has been well done. The payment for earth moved in both excavation and filling was authorized by the council. The plans for grading streets have been criticised because of damage to abutting property in some cases. Should the plans be changed there would probably be simply a change of the place at which such damage occurs. The short blocks, 264 feet, make adjustments of grades difficult and the numerous intersections increase the assessments on the affected property to pay for them. There are differences of opinion as to the treatment of side-hill streets, especially at intersections. The methods used are in common use. The numerous injunction suits have strained relations so that it is not advisable to make any changes in the plans and contract, although some minor changes could be made, reducing the cost a small percentage without affecting the quality of the work. The contract price has been complained of as high, $2.29 a square yard for asphalt paving, but it is due to higher local prices for materials and labor, and the net profit to the contractor is about 13 per cent., without allowing for the price of paving bonds, which may be as low as 88. Harmony is strongly urged, the citizens being assured that they are getting good work at prices which are not unreasonable, though probably not quite as low as they might have been had the financial side of the question been handled carefully before the contract was let.

Methods of Making Ordinary Extensions to Water Works—Effect of Political Influence on Expense.

In connection with their recent exhaustive study of the Boston Water Department for the Finance Commission, Metcalf & Eddy, consulting engineers of that city, sought to determine the general method adopted in making ordinary extensions to water works. Inquiries addressed to large cities throughout the United States show that out of seventy-seven cases extensions were made in five by contract and day labor, while in twenty-four the work was always done by contract, and in forty-eight by day labor. Interesting facts are shown by grouping the results according to the location of the cities as in the accompanying table, from which it appears that in the east usually one-third of the cities do extension work by contract, while in the central and western states from one-half to two-thirds of them employ the contract system.

METHODS OF MAKING WATER WORKS EXTENSIONS IN SEVENTY-TWO CITIES GROUPED ACCORDING TO LOCATION.

Location.	Number of Cities Which Make Extensions by Contract.	Day Labor.	Percentage by Contract.
New England	3	26	10
New York, Pennsylvania, New Jersey, Delaware, Maryland and District of Columbia	5	10	33
Virginia, Georgia and Florida	1	2	33
Ohio, Indiana, Illinois, Michigan and Wisconsin	5	4	56
Kentucky and Tennessee	2	..	100
Missouri and Texas	2	1	67
Minnesota, Iowa, Kansas, Nebraska and Colorado	3	3	50
Washington, Oregon, Utah and California	3	2	60
Totals	24	48	33

An interesting and instructive side light upon the lack of efficiency in city management of public service works is given in the same report by a comparison of the cost of operating certain portions of the works taken over from the Boston Water Department by the Metropolitan Water Board upon January 1, 1898. This transfer comprised the supplying works, including the reservoirs and aqueducts and the Chestnut Hill distributing reservoir and pumping station. The excess cost of city management of these works, other than the pumping station, in 1897, as compared with state management in 1898, was approximately 40 per cent., and of the pumping station approximately 50 per

cent., taking into account the changes in service required of the latter station. Conditions for a very interesting comparison are presented in the fact that identical works were in charge of the same man during one year for the city of Boston, and during the succeeding year for the commonwealth. The greatest saving under Metropolitan management was made in the localities where political influence had previously been the most effective, namely, where the employes voted in the city of Boston. Where the distance from Boston made the positions less attractive, and hence less sought after by men in search of sinecures, there resulted little change from the Metropolitan management. In a word, the reduction in cost was almost directly traceable to the removal of political influence.

Cost of Street Lighting in Des Moines, Iowa.

One of the places where considerable saving has been effected by the change in form of government in Des Moines, where the commission plan is now in operation, was in the electric light bills.

Under the present contract all arc lamps are paid for at $65 per lamp per year, 475 being the average number in operation. Under the old schedule 69 of these lamps burned all night at a cost of $95 a year and 235 burned all night at $75 a year. These lamps still burn all night, and the other 171 are carried, as before, on a moonlight schedule. This makes a saving of $4,380 a year. The price of all-night incandescent lamps is now $17.04, a reduction from $24 on 53 lamps, or a saving of $368.88. There are 532 incandescent lamps on moonlight schedule continued at the old rate of $17.04. The Welsbach gas lights, 1,119 in number, were reduced in price from $22 to $17, a total reduction of $5,595. This makes the total saving about $10,325.

Discounts for outages for the various classes of arc lights varied from 0.6 to 1.5 per cent. of the total amounts of the bills at the contract rates, 1.3 per cent. being about the average deduction. Discounts for outages on incandescent lamps varied from 1.4 to 2.4 per cent., the average being not far from 2 per cent. Discounts for outages on gas lights were less than 0.3 of 1 per cent.

Bonding New Concrete to Old.

Clean off with clear water and stiff broom the surface of the old concrete. Mix one part commercial muriatic acid or hydrochloric acid and three parts water, or use Bonsit or Ransonite, mixed according to directions with hot water, make several applications one after another with a brush containing little or no metal. This will not injure the concrete, as the acid does not sink to a sufficient depth before it is neutralized.

This will have the effect of removing the cement from the top surface of each grain of sand or piece of stone and the other aggregates that have been used, exposing the clean surface of these aggregates in exactly the same condition as they were before being mixed.

After applying the acid, wash the surface with clear water, scrubbing with a stiff broom or brush, removing all the dead particles. While the surface is still wet (and it should be thoroughly wet) apply the new concrete. Protect this new concrete by keeping it damp for at least a week. Do not let it dry out at any time during the first week.

It will be found that the new concrete will bond to the old as strongly as if both had been mixed at the same time.

ALBERT MOYER, New York City.

Joint Action of Cities in Abating Stream Pollution.

To the Editor of MUNICIPAL ENGINEERING:

Sir—At a conference held in Warren, Ohio, there were present about one hundred representatives from the various cities and towns in the Mahoning valley. The towns in this valley include Seabring, Alliance, Newton Falls, Warren, Niles, Girard, Youngstown and Struthers.

The engineers of the State Board of Health presented a report of their investigations covering a period of two years upon the waters of the Mahoning river, and the effect of manufacturing wastes and of the pollution of the sewage from the towns above, at or near the intakes of the water supplies below, and also immediately below the sewage outfalls of the various towns. The engineers' report included a summary of the studies of the various projects under way or in contemplation in the various towns as to sewage and water purification. There was no definite action taken by the representatives of the cities present, but the conference is to be followed by further negotiations between the towns on the subject matters discussed at this meeting.

One important matter discussed was the plan of the city of Youngstown to build large storage dams for regulating the flow of the Mahoning river, and the cities of Warren, Niles, Girard and Struthers, who would benefit by this plan, were asked to co-operate with Youngstown in the carrying out of this project.

ALEXANDER POTTER,
Consulting Engineer, New York City.

Mr. Potter delivered an address at this conference, from which the following extracts are made:

Let us assume for a moment the possibility of the city above purifying its sewage to a drinking water standard, and even preventing the treated sewage from entering the river at all; the city below still has no assurance that its water supply is safe, and this because there are so many other polluting factors, impractical and impossible to eliminate, such as the wastes and wash from farms, from manufactories and from mines along the river's

banks. Of course, if the public health could not be maintained without the complete purification of these wastes, as well as the cities' sewage, then what I am about to say falls to the ground; but this has not yet been proved.

If the time has not yet come, it most surely will come in the very near future when all surface supplies of water subject to any contamination, defilement or even serious turbidity must be purified before being used, the extent of the purification depending, of course, upon the amount and character of the defiling influences. The purification of water is so much more an exact science than the purification of sewage, and the results obtained therefrom give so much greater positive and direct returns for a given expenditure, that the expenditure of money on sewage disposal plants for the purpose of purifying water supplies is in most cases a misdirected expenditure of public money.

Let us take as a fundamental and basic principle that no town or factory or mine should be permitted to maintain a nuisance on its own premises or on the premises of its neighbor, and, viewing the situation in this light, greater progress can be made. No city and no manufacturer enjoys being accused of maintaining a nuisance.

The expense of purifying the sewage of any town to such a degree as to positively insure the water supply of the town below against pollution from that town is prohibitive in a vast majority of cities throughout the United States, and because those in authority in some cities hold the view that sewage disposal is a prime essential to water purification, and not that the water supply itself should be purified, many rational and beneficial improvements are postponed.

The problem of sewage disposal is solved when we maintain a proper proportion between the amount of sewage discharged into and properly diffused throughout a body of water and the ability of that body of water to absorb the sewage. Generally speaking, this condition will obtain by the discharge of one volume of crude sewage, or its equivalent in treated sewage, to fifty volumes of water. The method of sewage disposal which can most economically perform this service is the one that should be adopted; there is no one method applicable to every case.

State boards of health have been given extraordinary powers in many of the states, but only as these powers are used wisely and well will they be respected. Cities are not likely to follow the edicts of the state boards of health blindly, no matter what powers have been given to these state boards of health to enforce edicts thus promulgated. The state itself is not warranted in expending large sums of money in preliminary investigations in each particular case, in order to enable the board of health to give a wise and fair judgment, but each city may do this for itself and the expense will not be felt.

That the Ohio State Board of Health at least does not expect cities to blindly follow its mandates is illustrated in the case of Warren. Ordered at first by the State Board of Health to prepare a design for a sewerage system and a sewage disposal plant that would eliminate all storm water from the sanitary sewers, and thus compel the city to abandon the use of many of the existing sewers, well constructed as sanitary sewers, the city's consulting engineer thought that in the case of Warren it would be a better sanitary plan, and more economical withal, to use certain of the sewers already built as combined sewers, in conjunction with storm water overflows, thus permitting the direct discharge into the river of a portion of the contents of these sewers during very heavy rains. By this plan, during the dry weather and during times of light rain, all sewage and foul street water is carried to the disposal plant. During heavy rains a portion of dilute sewage is discharged directly into the river. The total amount of objectionable matter intercepted from the river by this plan is as great as when there is a dual system. Some cities lend themselves admirably to a dual system, but only on the score of economy, and not on the score of health, is the dual plan permissible. The Board of Health took a most sensible view of this matter, and did not feel aggrieved because of this apparent questioning of the wisdom of their conclusions. They were glad to consider the city's more extended investigations and studies in this matter, and to modify their opinions in accordance with these new facts. They gave Warren's representatives a very respectful hearing, and, what is more to the point, they duly rescinded their former action and agreed to allow the use of combined sewers under very proper restrictions set forth in the permit.

Cement Importations.

The falling off in importations of cement is shown by the customs reports of 2,957,325 barrels in 1907, valued at $3,669,926; 1,509,047 barrels in 1908, valued at $1,973,472, and 506,249 barrels in 1909, valued at only $712,628. In each case the year ends with June 30 of the year named. There were re-exported in 1908 20,451 barrels and in 1909 5,320 barrels.

Exports of domestic cement increased from 709,455 barrels in 1907 to 945,421 barrels in 1908, and fell off again to 827,971 barrels in 1909.

There was an increase in the value of the imported cement from $1.24 in 1907 to $1.31 in 1908 and $1.41 in 1909. At the same time there was a decrease in the value of exported American cement from $1.67 in 1907 to $1.55 in 1908 and $1.38 in 1909.

MUNICIPAL MATTERS IN COURT

Higher Courts—Street Widening

Decisions of the Higher Courts of Interest to Municipalities.

BY J. W. KENNEY, ATTORNEY, INDIANAPOLIS, IND.

Defective Sidewalk—Liability.—A city denying responsibility for the work of trespassers who tore up part of a board sidewalk in a street and replaced it with cement can not evade liability for failure to repair a defect in a connecting walk on the ground that temporary barriers erected by such trespassers to protect the cement until it solidifies were removed without the city's consent. (Robinson v. City of Omaha [Neb.], June 11, 1909.)

Power of Council to Abate a Nuisance.—Under Hurd's Rev. St. 1908, Sec. 62, giving the city council power to declare what shall be a nuisance and to abate it, the decision of the city council that a building was a public nuisance was not final, but the question may be adjudicated in an action for damages for its destruction. (Sings v. City of Joliet [Ill.], 86 N. E. 663.)

Ordinance Imposing Fine for Building Without Permit is Void.—An ordinance providing that every person, firm or corporation doing or causing to be done, and every owner of land permitting to be done, any work in or about the construction or reconstruction of a building without a permit, shall be fined, etc., and making every day's violation of the ordinance after service of the warrant issued on the first offense a distinct offense, is void for want of legislative authority; Gen. Laws 1891, c. 40, Sec. 21, authorizing towns to pass ordinances for the ordering of the prudential affairs and police of their town not repugnant to the Constitution and laws of the State or of the United States, not authorizing the ordinance. (State v. Crepeau [R. I.] 71 A. 449.)

Construction of Fence Encroaching Upon an Alley—Injunction.—Where a property owner on an alley without a permit from the city erects a fence, encroaching on the alley from 1½ to 3 inches, and the fence causes no special damages, either actual or threatened, to a complaining property owner on the alley, injunctive relief will be denied, especially when it is shown that complainant's fence also encroaches on the alley. (Frailinger v. Cooke [Md.], 71 A. 529.)

Obstructions in Street—Suit to Remove by Abutting Property Owner.—Though an individual owning property abutting on a city street can not sue to compel the removal of obstructions in the street which constitute a public nuisance without showing damage peculiar to himself, not suffered in common by his fellow citizens, he may maintain the action where the injury is peculiar to himself and interferes with his right of ingress to and egress from the property. (Shoemaker v. Coleman [Miss.], 47 So. 649.)

Continued Occupation of Street Gives No Prescriptive Right.—The continued occupation by one of a portion of a public street by maintaining a house thereon is a continuance of a nuisance created by the obstruction, which under Civ. Code, Sec. 3499, can not by lapse of time be legalized, and the public officers charged with the duty of removing obstructions from streets may remove the same on the refusal of the owner so to do. (Nerio v. Maestretti [Cal.], 98 P. 860.)

Injury to Property Owner by Excavation—No Liability.—Where the owner of a house adjacent to a public alley in which the city was lowering the grade and excavating knew of the excavation two weeks before the work reached the end of the alley where the house stood, that the work would occupy the whole width of the alley, that his house abutted immediately thereon and was above the established grade fixed by the engineer, and that it would require excavation right up to the wall of the house, and where he also knew the depth of the foundation of his house, which the city did not, his knowledge dispensed with any formal notice by the city of the commencement and progress of the work so as to enable him to support his building, where the plan for the grading of the alley did not call for a trespass or the commission of a nuisance, but only provided for a lawful improvement of an established highway. (McGrath v. City of St. Louis [Mo.], 114 S. W. 611.)

Municipality Not Liable for Interest on Contracts.—A municipality is not liable on its contracts for interest in the absence of an express agreement to pay it, but where money is wrongfully obtained, or where it is lawfully obtained and unlawfully and wrongfully withheld, the municipality is liable for interest to the same extent as a private person. (Conway v. City of Chicago [Ill.], 86 N. E. 619.)

City's Duty to Keep Streets Safe for Travel.—The duty of a city to keep its streets and sidewalks safe for public travel

requires it to protect by proper barriers or coverings all obstructions or dangerous holes or other perilous places. (Revis v. City of Raleigh [N. C.], 63 S. E. 1049.)

New Ordinance Intended to Replace Old One—Repeal.—Where it clearly appears that a new ordinance was intended to replace the old one and embraces the entire regulation on the subject, it will be construed to repeal the old ordinance, though there is no provision in the new one that specifically repeals the other.—Indianapolis & E. Ry. Co. v. Town of New Castle (Ind.) 87 N. E. 1067.

Grant of Power to Municipal Corporation.—A grant of power to a municipal corporation by the legislature will be construed most strongly against the corporation.—Mantel v. State (Tex.) 117 S. W. 855.

Ordinance Unenforcible.—Where there is no substantial connection between the assumed purpose of an ordinance and the end to be accomplished, it is unenforceable. —People v. Murphy (N. Y.) 88 N. E. 17. (See also 88 N. E. 21).

Invalid Ordinance.—An invalid ordinance will not repeal another ordinance.—Ensley v. State (Ind.) 88 N. E. 62.

Park Commissioners Powers Over Street Improvements. — Supplemental South Park Act, April 16, 1869, vesting in park commissioners such powers over streets which adjoin parks as may be necessary to improve and keep the same in repair in connection with the parks, etc., does not divest the city of Chicago of the power to improve the surface of a street adjoining a park, unless the improvement has been actually assumed by the park commissioners.—City of Chicago v. Mandel (Ill.) 88 N. E. 226.

Contract—Not Approved by Proper Board—Liability.—Laws of 1896 (p. 751, c. 626), provides for the rebuilding of the New York City prison, authorizes the commissioner of correction to employ architects to prepare plans, and declares that when any work provided for by the act, shall have been authorized and the plans therefor approved by the board of estimate and apportionment, the commissioner of correction shall carry out the work. The board of estimate and apportionment, on approving the general plans, authorized the construction of the building, with the exception of the cell work and certain other work. The architects who had prepared the general plans were employed by the commissioner of correction to prepare detailed plans and specifications for the construction of such cell work, etc., in the prison, but these plans and specifications were not approved by the commissioner or by the board of estimate and apportionment, and to the time when the services of the architects were dispensed with, the work had not been authorized by the board of estimate and apportionment. *Held*, That the city was not liable to the architects for the compensation which the commissioner had agreed to pay them for preparing such detailed plans and specifications and supervising the work.—Withers v. City of New York, 87 N. E. 1130.

Selecting Bricks of Particular Manufacture—Action Illegal.—Where there are several kinds of vitrified bricks equally well suited to use for paving, the selection by the board of public works of the bricks of a particular manufacturer, thereby cutting off all opportunities for the manufacturers of all other kinds of vitrified bricks to submit bids, as provided by the city charter, is illegal.—Glennon v. Gates (Mo.), 118 S. W. 98.

Decision of Engineer as to Construction —Stipulation in Contract Binding.—A stipulation in a contract between a city and a contractor for a public work that the work should be done under the supervision and to the satisfaction of an engineer in charge whose decision as to the construction of specifications, and whose estimates should be final, is valid and binding.—City Street Improvement Co. v. City of Marysville (Cal.), 101 P. 308.

Trees in Street in Front of Premises.— While an abutting owner may plant trees in a street in front of his premises, and may acquire an interest in them, which the law will protect, as against a trespasser, yet such trees are subject to the rights of the public, and where in making the street conform to the established grade or in constructing a sidewalk, it becomes necessary to remove the trees or injure them, the owner has no relief.—Morris v. Salt Lake City (Utah), 101 P. 373.

Specifications Must Be on File When Contract is Let.—Under Ann. St. 1906, sec. 5859, providing that contracts for street paving, etc., shall be let to the lowest bidder on plans and specifications filed therefor with the city clerk by the city engineer, it is an essential prerequisite to a valid assessment that the plans and specifications be on file when the contract is let.—Jones v. Plummer (Mo.), 118 S. W. 109.

Basis of Assessment Against Railroad's Right of Way.—A railroad's right of way is regarded, for the purpose of a public improvement assessment by a municipality, as land permanently devoted to a public use, and the benefit to the land in such use, and not the enhancement of its market value, is the proper basis of its assessment.—New York Bay R. Co. v. City of Newark (N. J.), 72 A. 455.

Enforcement of Street Improvement— Lien Against Purchaser of Property Charged.—A purchaser of real estate charged with a lien for a street improvement could have seen the improvement, and he was aware of the power of the city to order the improvement at the cost of the property, and that the cost was a lien thereon. The purchase was made in January, 1907. The apportionment warrant for the cost of the improve-

ment was issued in August, 1905. *Held*, That the right to enforce the lien against the purchaser was not barred by laches; the lien being good under the statute for five years.—Hughes v. Wallace (Ky.), 118 S. W. 324.

Ordinance Requiring Permission to Be Obtained from Council to Make Repairs.—Acts 1901, (p. 430, c. 151, section 28), amending the charter of the city of Elkins, empowers the council to provide for the regular building of houses or other structures and the kind of material to be used. Section 42 reserves to the city all the rights and powers granted it under Code 1906, c. 47, and by section 28 of that chapter (section 1868) the council of a city is empowed to make regulations guarding against damage by fire. Pursuant to such authority the city passed an ordinance requiring permission to be obtained from the council to alter, change, or repair a building already constructed. *Held*, That a refusal by a city council to permit the owner of a house to make such minor alterations, changes and repairs as the replacing of windows and doors, the removal and re-location of partition walls, and the painting of the outside walls was an unreasonable application of the ordinance, and that the ordinance will not be construed as authorizing the council to withhold permission to make such minor and necessary repairs.—Harvey v. City of Elkins (W. Va.), 64 S. E. 247.

Awards for Buffalo Street Widening.

The supreme court of New York issued an order, August 16, confirming the awards for widening Elmwood avenue, in Buffalo. The proceeding involved 57 parcels of land and represented a total of $190,624.94. Substantial awards were given in all instances excepting six property owners who were given the nominal award of six cents. The improvement is intended to relieve the congestion of Main street.

MUNICIPAL AND TECHNICAL LITERATURE

Washington Parks—Water Front and Water Supply—Kenosha Water Works—Municipal Reports—Web Stresses in Concrete—New Publications

Park Improvements in Washington.

Col. Cosby, the engineer officer in charge for the preservation and improvement of the public parks and reservations in the District of Columbia has submitted estimates aggregating $399,570 for the next fiscal year. He desires to open to the public a portion of Potomac Park east of the railroad embankment, and requests $50,000 to commence the construction of roadways therein. His estimates include the following items: Potomac Park roadways, $50,000; for park watchman's lodges, $5,000; grading Henry Park, $25,000; oil for macadam roads, $5,000; Executive Mansion roads, $3,500; Grant memorial balance, $83,000; for small reservations, $4,000; for children's playgrounds, $3,000; increased pay for park policemen.

Land Reclamation on Washington's Water Front.

Renewed interest in the proposed reclamation of the Anacostia flats has been aroused at Washington, D. C., by the district commissioners' appointment of Hugh T. Taggart to investigate and determine the ownership of riparian lands along the Eastern branch of the Potomac. It is believed that, once the question of ownership of land along the river is settled, Congress will promptly appropriate a sufficient sum of money for the beginning of the work. In a report to Congress in connection with the work of Mr. Taggart on the riparian rights along the stream, the district commissioners said:

In the report of the War Department made in 1898 the assessed value of what was considered private land was put at about $23,000, but there can be no question that the value as determined by a jury will be many times greater. The value of the riparian privileges may be very small on account of the shallowness of the stream and the present non-availability for commercial purposes, but, on the other hand, it may amount to a million dollars or more.

To offset this cost there will be in the commercial section a filling in of 600 or more acres of land which if the riparian rights are obtained will belong to the United States and can be utilized either as a park or sold for commercial use. This will offset to a considerable extent the cost of the project and if it is leased

will doubtless give an adequate return on the money spent.

Within any reasonable cost, and it is thought that $3,000,000 or $4,000,000 is reasonable, the desirability of this improvement is extremely great. The land now available for wharfage facilities in Washington is too limited and the wharf frontage is now already crowded. To carry out the project would quadruple the water front along a navigable channel.

Benefit of Water Meters Demonstrated.

An official statement issued by W. A. McFarland, superintendent of the water supply for the District of Columbia, shows that the daily and annual consumption of water in the District for all purposes is less per capita now than it was ten years ago. That the consumption has been largely reduced by millions of gallons is due to two principal factors in the improved and modern administrative methods adopted by the water department. The report says:

In 1900 the daily average consumption of water was 48,500,000 gallons. The following year it jumped more than 2,000,000 gallons. One year later there was an increased demand of more than 6,000,000 gallons. In 1903 it went to 10,000,000 gallons above what it was in 1900. The next year it jumped 5,000,000 gallons daily and the next year increased only 2,000,000, the consumption in 1905 being 65,000,000. At the close of 1906 it was found that the consumption had run up to 67,500,000 gallons. The next year there was a decrease of 500,000 gallons daily, and in 1908 consumption had fallen to 65,000,000 gallons. In 1909 it was reduced by 3,800,000 gallons, as compared with the previous year.

The fact that the abnormal yearly increase in the daily consumption of the water supply came to a standstill in the year 1907 was in large measure due to the installation of water meters. With the introduction of these machines showing how much water hotels, livery stables, and other large consumers and householders were using, there was a gratifying reduction of the waste that threatened to force the government to double the capacity of the supply. Again it will be noted that in 1908 there was a decrease of more than 2,000,000 gallons in the daily consumption of the supply. This was due to the introduction of the pitometer and the exercise of expert intelligence in the management of the service that quickly located the daily loss of 5,000,000 gallons of water.

Encouraged by the excellent work in saving such a large waste of water, the consumers being required to pay for what they use, and, by the success of the pitometers and expert service in locating leaks in broken mains, the officials of the department pushed the work with vigor.

As a result of that campaign, in the early part of the present calendar year 7,600,000 gallons daily waste was found. An additional loss of 2,000,000 was stopped at the Washington Navy Yard. In some cases leakage was the cause, while in many reckless waste prevailed.

Had the heavy increase in the daily consumption of water that marked the annual record from 1900 up to 1906 been maintained to date, it would have reached the enormous daily consumption of 81,000,000, leaving only 9,000,000 gallons daily margin between the supply capacity of the aqueduct and the demands. This surplus would have been absorbed in less than two years, had the ratio of consumption increased as it had in the past, and in less than three years the demand from consumption would have been in excess of the supply capacity of the aqueduct. This would have been a condition and not a theory that Congress would have been forced to treat with heroic methods.

The opinion has prevailed for years that it would be necessary for Congress to provide at least $5,000,000 for the enlargement of the water supply. But the survey conducted by Maj. Jay J. Morrow, Corps of Engineers, U. S. A., in charge of the Washington Aqueduct, reported to the Secretary of War that, with the expenditure of a small sum, the physical condition of the conduit could be made to last for twenty years, and by the extension of the pitometer and water supply meter system the present supply system would be equal to all demands.

But for the methods of economy in cutting down the abnormal waste of water the report of Maj. Morrow would have been a different one, and the extension of the service would have been a pressing necessity.

It is estimated there is an annual increase in population of 6,000, which in ten years would amount to 60,000 consumers. The highest per capita consumption was in 1904, when it was 210 gallons. At the present rate of consumption, with the economies put in force, it is only 178 gallons. Had the natural increase reached 81,000,000 gallons a day, the per capita consumption would have been 235 gallons.

The receipts for the year 1900 were $349,339.01, which increased yearly by $100,000, until 1905, when the receipts fell to $395,798.52. Expenses for the period from 1900 to and including 1909 amounted to $5,096,018.08, among the expenditures being the constant extension of the water main distribution service in the suburban sections. Of this sum $3,337,601.77 has been expended in the installation of the pipe and fire hydrants of the high-pressure water service.

With the general introduction of meters there will be a large reduction of daily consumption, and a corresponding decrease in cost of operation and maintenance.. Washington's water supply and distribution system are looked upon by other municipalities as a model of successful economic operation of a public utility under municipal ownership.

An aggregate estimate of the value of the supply and distribution service, as an asset, could not be obtained, for the reason that three of the largest and some of the smaller supply distribution mains are the property of the Federal government, operated by the District government. No record of the value of the entire plant is available.

Kenosha Has a Profitable Water Department.

The municipal water-works plant at Kenosha, Wisconsin, is treated in a report that has been made public, showing that during the last twenty months the plant has earned for that city profits aggregating nearly $50,000. Since it was

built the plant has been self-supporting, and in addition to maintenance and extensions, the company has retired bonds to the amount of $60,000 since the company became a municipal proposition in 1895.

The total indebtedness of the company is $77,000, and the total cost of the plant and the extensions has been $252,737.85. The operation of the plant has not only been profitable for the city, but, it is stated, that the rates charged for water in Kenosha are lower than those charged in any city in Wisconsin.

Municipal Reports.

First Annual Report of the City of Des Moines, Iowa, 1908. John W. Hawk, Auditor.

The city of Des Moines has been operating for a year under the commission form of government and the auditor has published the first report, in fact the first annual report issued since the organization of the city in 1851

The act under which the city is operated and the ordinance fixing the details of operation open the volume. Then follow a full list of the city employes, a statement of assets and liabilities, cash, warrant and bond statements, receipts and disbursements of all the various funds.

These statements are then collected and combined in schedules and classifications as provided by the State law upon uniformity in municipal accounts, and comparative statements in some cases for two years and in others for eight years are given with as much accuracy as is possible under the lack of data for previous years.

The report is strictly tabular and statistical and is in sufficient detail to show the operations of all the departments, and the financial and numerical results capable of tabulation.

The inventory shows that the city owns real property amounting to $2,359,931.50, personal property equal to $213,087.11 and had on April 1, 1909, $333,414.43 in cash on hand. Liabilities, mainly bonds, with a few unpaid claims and warrants amount to $1,077,180.34, showing a balance of over $1,800,000 in the city's favor.

Expenditures for the year amounted to $955,546.71, nearly all for current expenditures. The cost per capita on an assumed population of 100,000 is given for each of the principal funds, showing that the total expenditures for maintenance of the city were $7.44 and for permanent improvements were $2.12 per capita.

The figures given do not include permanent improvements paid for by assessments upon property. The paving, curbing and sewers in existence have cost over $4,700,000, and $357,755.50 were expended during the year of the report for paving, curbing, gutters, sewers and sidewalks. Total and unit cost are given or can be readily computed from the figures given.

This report shows the great advances that have been made in recent years in rational and scientific study of municipal operations.

Investigation of Web Stresses in Reinforced Concrete.

The resistance to failure by shear and diagonal tension and the effectiveness of metallic web reinforcement are discussed in Bulletin No. 29, Tests of Reinforced Concrete Beams: Resistance to Web Stresses, by Arthur N. Talbot, issued by the Engineering Experiment Station of the University of Illinois. This bulletin of 85 pages gives the results of tests made in the Laboratory of Applied Sciences of the university. The strength and quality of the concrete itself are shown to have a marked effect on web resistance, and the importance of securing a high grade of concrete in beams subject to large web stresses, even if metallic web reinforcement is used, is brought out strongly. Data are given on which to base the age necessary to enable concrete to take shearing stresses. It is established that the less the ratio of length of span to depth of beam the greater the shearing resistance developed per unit of cross section, and also that the greater the amount of longitudinal reinforcement the greater the shearing resistance. Both effects depend upon added stiffness, a relation which has not been formulated before. Several types of web reinforcement were investigated—bent-up longitudinal bars of different forms, unit frames, vertical stirrups of different sizes and proportions, smooth and deformed bars, etc. The notes and discussions given add to the value of the matter for those who wish to study the details of the tests. The analytical treatment of web stresses, the discussion of the experiments and the remarks on proportioning stirrups may all be helpful to engineers. Although a considerable fund of information bearing on the part taken by the resistance of longitudinal reinforcement and the compressive resistance of concrete has accumulated, the data of web stresses are less definite and less complete. This monograph is therefore timely, and it ought to take rank as an important contribution to the literature of reinforced concrete. There is no charge for these bulletins.

New Publications.

Handbuch fuer Eisenbetonbau. Edited by F. von Emperger. Second volume. Reinforced concrete materials and their preparation. 243 pp. Paper, 12 marks. Third volume, Examples of reinforced concrete construction; second part, liquid containers, pipes, sewers and open canals, aqueducts and canal bridges, tunnels and underground railways. 311 pp. Paper, 15 marks. Wilhelm Ernst & Sohn, Berlin, Germany.

This "handbook" is in several volumes and parts, but is what its name indicates, a book for practical use in designing re-

inforced concrete structures and in designing forms for putting concrete in place. The volumes are written by several experts in their respective fields and give an excellent report of the state of the art and science of building in reinforced concrete as it exists to-day. Many examples are given and enough of the theory to make the books as complete as need be for all ordinary and much unusual work.

The "second" volume begins with the materials and has chapters on the forms and characteristics of various forms and qualities of iron and steel used in reinforcement, the kinds, qualities and testing of cement, the sand, stone and gravel used in mortar and concrete, the water used in mixing, the qualities and strength of various mixtures of mortar and concrete, methods of testing strength, waterproofing, etc. It also gives illustrated descriptions of many forms of concrete mixers, devices for measuring the proportions of materials automatically and by hand, cars, barrows, elevators, cranes, etc., for handling and placing concrete, and machines for forming, cutting and placing the reinforcing metal. The chapters on forms in which to deposit concrete are particularly full and detailed. Besides giving drawings of various methods of putting the forms together and fastening and supporting them, many photographs and drawings of forms in use on structures are given, a large number of them with full dimensions (metric system). In this respect the book is more complete than any other that has been published. The various forms are grouped in chapters on forms for buildings, forms for truss bridges and forms for arches and arch bridges.

The "third volume," after a few pages on methods of making concrete impervious to liquids and some formulae for computing strength of the structures, gives details of reinforced concrete tanks for holding liquids, beginning with roofs, and including walls, partitions and bottoms, and many special designs of tanks, water towers, filters, basins, reservoirs, cisterns, baths, gas, tar and ammonia tanks, containers for various manufactories, and liquor and wine cellars, in the ground, on the ground and elevated on towers. Another division discusses reinforced concrete sewers, conduits, siphons, inverted siphons, hollow telegraph poles, pipes, aqueducts, giving details and formulae for computing dimensions, methods of testing strength and permeability and results of tests. There is much information about methods of construction also. One chapter is devoted to tunnels, shafts, pump wells, mine drifts, underground railways, passenger subways, ventilation tunnels and the reinforced concrete lining for them, giving details of centers, dimensions, reinforcement, etc.

A book like this is needed in English, and this one will be very useful to those who have a little knowledge of German, with a little trouble in changing dimensions to English measures.

Manual of Examinations for Engineering Positions in the Service of the City of New York. To which are added appendixes giving examination papers, etc., in the civil service of the Federal Government, including the Panama canal and the U. S. Navy, New York State, Boston, New Orleans, etc. By Myron H. Lewis, C. E., and Milton Kempner, A. B., C. E. Cloth, $5, net. Engineering News Publishing Co.

Three volumes, each with several parts and appendixes are bound in one and as each part and appendix is paged separately, the table of contents is meager, and an index is lacking, reference to any particular subject is not easy. This is the most serious criticism of the book, which gives numerous examples of examination papers in the services named in the title page, and others, and answers to many of the questions which have been and are likely to be asked. These answers are brief and to the point and are quite a satisfactory guide to the young student in his preparation for work in the lines covered as well as for the examinations.

The parts in the first volume are devoted to the axeman, the chainman and rodman, the leveler, and the transitman and computer, and an appendix gives some formulas useful in surveying. The second volume has parts for the assistant engineer on the rapid transit commission and on general, aqueduct, dock, sewer, and highway work and its appendix gives some useful engineering formulas. The parts of the third volume give the papers for draftsman and draftsman's helper and for inspectors of buildings, masonry and carpentry, steel, regulating, grading, paving, and sewers. One of the general appendixes is devoted to the civil service of the United States and one to the civil service of New York State, with examples of papers from several cities such as Chicago, New York, Boston and Buffalo. Extracts from laws and regulations are given.

Artificial Stone, Etc. The Illustrated Carpenter and Builder series of technical manuals. Edited by John Black. 92 pp., stiff paper cover. 25 cents. John Dicks, London. Industrial Publication Co., New York.

This book contains a rather ineffective treatment of its subject and has little or nothing which is new ot American readers, in fact, most of its modern information is drawn from American sources. It describes early manufacture and use of concrete and artificial stone; construction, manufacture and use of mosaic; systems of paving; artificial stone as a paving material; testing building stone; artificial sandstone sills, bricks and blocks; hydraulic machinery; hollow stone building blocks; scagliola and enameled slate; other methods of making artificial stone; terra cotta, its history, manufacture, cost, use, etc.

Modern Steam Engineering in Theory and Practice. A new, complete and practical work for steam-users, electricians, firemen and engineers, containing latest practical information on boilers and their adjuncts; economy of steam-making and its use. From the fuel to the condenser, with illustrated details of steam engine parts; superheated steam, its use and economy; details of slide-valve and high-speed engines; Corliss compound, and triple-effect engines; the steam turbine and its work; the cost of steam power, its application and operation in power plants for electric generation, pumping, refrigeration and elevators. Over two hundred questions with their answers, likely to be asked by the examining boards are given, as well as forty tables of the properties of steam for power and other uses. By Gardner D. Hiscox, M. E., with chapters on electrical engineering by Newton Harrison, E. E. 487 pp. Cloth, 405 illustrations, $3.00. The Norman W. Henley Publishing Co., 132 Nassau St., New York.

The above description of Mr. Hiscox's book, taken from the title page, gives a good general idea of its purpose and of the twenty-three chapters written by him. As stated, the book is written from the practical standpoint and treats most of the subjects in a manner to make them readily understood by those for whom the book is designed, though sometimes in a style a little too general for direct application. This is really necessary, however, on account of the limitations of space and there is plenty of detail about many subjects.

The chapters in the electrical section give some instruction in dynamo operation, regulation and testing for defects, in the operation of the appliances on the switchboard, and on electric lamps of various sorts, such information as the steam engineer is likely to need in many modern steam plants.

Practical Cement Testing. By W. Purves Taylor, M. S., C. E. 320 pp. Cloth, $3. The Myron C. Clark Publishing Co., New York and Chicago.

Mr. Taylor's book is eminently practical, and it also gives very good indications of the theories underlying the best practice. It gives some statements regarding laboratory methods in use by several good cement testers and in special detail those in use in Mr. Taylor's own laboratory, the municipal laboratory of Philadelphia.

The various chapters classify cements and give historical and statistical data, discuss the composition and constitution of the various kinds of cement and those made of various materials; the methods of manufacture; and then in detail for Portland cements, methods of inspection and sampling; the classification of tests; and the apparatus and methods of manipulation of tests for specific gravity, fineness, time of setting, tensile strength and soundness; methods of chemical analysis; and mention of various special tests which have been used at times for various purposes. Each of these chapters goes into minute detail and is illustrated to show the actual handling of the material. One interesting chapter gives methods of making approximate tests in the field or office with home-made apparatus. Another describes in full the equipment of a good testing laboratory, showing the amount and quality of labor required, the cost of operation and the methods of recording results. One chapter gives the modifications of tests, etc., required for other than Portland cements and some forms of standard specifications.

Appendixes contain the standard testing methods of the American Society of Civil Engineers, the standard program for chemical analysis of the New York section of the Society for Chemical Industry and the standard specifications for cement of the American Society for Testing Materials, the Corps of Engineers, U. S. A., the British Society of Civil Engineers; also a list of books on cement and concrete.

Smoke Prevention and Fuel Economy. By Wm. H. Booth and John B. C. Kershaw. 194 pp. Cloth, $2.50. Norman W. Henley Publishing Co., New York City.

The authors of this book are English engineers, although Mr. Booth is a member of the American Society of Civil Engineers, and their book is based on a German book by E. Schmatoll, to which has been added much to fit the book to English practice and from which less suitable matter has been subtracted.

The first appendix gives sample specifications of English, German and American patents for smokeless furnaces and devices for producing complete combination of fuel and the patents chosen deal chiefly with devices for supplying secondary air in the English, with grate and furance construction in the German, and with mechanical or automatic stoking appliances in the American section.

It is probably apparent from these statements that a German book, revised by Englishmen, is not wholly applicable to American conditions and fuels. The book has a value, however, for its discussions of the chemistry of the combustion process, of the defects and the possible improvements in methods of burning fuel and the descriptions of methods of examining the waste gases and the combustion process and controlling them. These chapters are not complete, even from the Englishman's point of view, but will be aids to the student of the subject, so that the book, in the comparative dearth of books devoted particularly to it, will be worth its price to the student and young engineer.

ORGANIZATIONS AND INDIVIDUALS

Techoical Meetings—Schools—Civil Service—Montreal Reform—Personal Notes

Technical Meetings.

The fourth international sanitary convention of American republics will be held in San Jose, Costa Rica, December 25, 1909, and lasting until January 2, 1910. Dr. Walter Wyman, chairman International Bureau, Washington, D. C.

The second annual National Good Roads convention will be held at Cleveland, Ohio, September 21, 22 and 23, under the auspices of the American Automobile Association and other organizations. The dust problem will be given much consideration at this convention, as no subject looms more prominently before the motorist, the farmer and other drivers on the road than the question of dustless roads. At the convention will be an exhibit of the Filbertine dustless road, asphalt and cement construction under the direction of T. Hugh Boorman.

The annual meeting of the Association of Edison Illuminating Companies will be held at Briarcliff Manor, N. Y. D. L. Huntington, sec'y, Spokane, Wash.

The annual convention of the New England Water Works Association will be held at New York City, September 8, 9 and 10. Willard Kent, sec'y, 715 Tremont Temple, Boston, Mass.

The annual convention of the International Association of Municipal Electricians will be held at Atlantic City, N. J., September 14, 15 and 16. Frank P. Foster, sec'y, Corning, N. Y.

The annual meeting of the Michigan Gas Association will be held on board steamer sailing from Detroit, Mich., September 14, 15, 16 and 17. A. P. Ewing, sec'y, Gas Office Bldg., Detroit.

The annual convention of the American Public Health Association will be held at Richmond, Va., October 19, 20, 21 and 22. Charles O. Probst, sec'y, Columbus, Ohio.

The annual meeting of the American Gas Institute will be held at Detroit, Mich., October 20. A. B. Beadle, sec'y, 29 W. Thirty-ninth st., New York City.

The third annual convention of the Illuminating Engineering Society will be held in New York City, September 25, 26 and 27, at the time of the Hudson-Fulton celebration, in the Engineering Societies' building, 25 W. Thirty-ninth st.

The managers of the state fair of Louisiana have fixed November 3 as Good Roads day, and Governor Sanders has expressed his intention to be present and make an address.

No hint of the program of the convention of the American Society of Municipal Improvements, to be held in Little Rock, Ark., November 9 to 11, has yet been received, but experience of the past makes it certain that it will be worth while, and municipal officials and others interested in municipal improvements should begin to make their preparations to attend the meeting.

The management of the International Exposition of Railway and Other Land Transportation, to be held in Buenos Aires, Argentine Republic, May to November, 1910, send a sheet of pictures of the buildings now under construction for the exhibition.

The executive committee of the Museum of Safety and Sanitation, 29 W. Thirty-ninth st., New York City, is arranging for a lecture tour of its director, William H. Tolman, beginning in October and continuing for six months. The lectures are offered without cost other than the local expenses for hall, lantern and publicity. The first three months are to be spent east of Pittsburg and the other three west, the tour extending as far west as St. Louis.

Engineering Schools.

The latest bulletin of Purdue University, Lafayette, Ind., gives detailed information about the courses of study in the School of Agriculture for the coming year.

The year book of the Michigan School of Mines, Houghton, Mich., is received; also one of the Allen School, West Newton, Mass.; and of the Thomas S. Clarkson Memorial School of Technology, Potsdam, N. Y.

U. S. Civil Service Examinations.

Among the examinations to be held during the fall of 1909 by the U. S. Civil Service Commission, the following may be of interest to our readers: Aid, Coast and Geodetic Survey; civil engineer in departmental service, civil engineer and draftsman, civil engineer and superintendent of construction; computers in Coast and Geodetic Survey, Naval Observatory and Nautical Almanac and Supervising Archi-

tect's offices; draftsmen, architectural, topographic copyist, engineer, heating and ventilating, junior architectural and topographic in Supervising Architect's office, departmental and Isthmian canal services; scientific assistant in the Department of Agriculture; superintendent of construction; surveyor in Philippine service.

Examinations will be held at the usual places as follows:

August 24, 25: Assistant, Class E, Naval Observatory, at $1,000.

August 26, 27: Assistant, Class 2, Naval Observatory, at $1,400.

September 22, 23: Topographic draftsman in Surveyor-General's office, Phœnix, Ariz., at $4 a day.

Civic Reform in Montreal.

Investigations being conducted in the civic affairs of Montreal, Quebec, by the provincial government, reveal the fact that the city has lost millions of dollars in contract work and that official positions of all kinds have been bought and sold for years. It is alleged that in the fire and police departments positions were openly bought and sold at $200 each, and in the public works department sworn testimony was offered showing that the lowest bidders were ignored and the contracts awarded to the highest bidders who had a "pull." The excess price paid by the city for paving averaged 60 cents a square yard, and on contracts let this year at a total price of $650,000, the excess price, it is alleged, amounted ot $130,000. In one department alone the crooked transactions have cost the city from $250,000 to $500,000 a year.

Partly as a result of the revelations of the investigation and partly as a movement for civic reform generally, an election will be held September 20 to vote on the question of reducing the number of aldermen by one-half.

Progress in Cuba.

With the beginning of the present fiscal year the Republic of Cuba established a Bureau of Information, President Gomez appointing Leon J. Canova, an American newspaper man, who has resided in Cuba eleven years and has a wide experience with the island, as its director.

Parties wishing information of any nature concerning Cuba can obtain same, free of charge, by writing to Leon J. Canova, Utility and Information Bureau, Department of Agriculture, Commerce and Labor, Havana, Cuba.

Personal Notes.

William S. Corn has been appointed city engineer at Billings, Mont.

Judge Lewis S. Hyer, former mayor of Rahway, N. J., died August 15.

Roswell M. Roper has been appointed assistant engineer of the water department at East Orange, N. J.

W. C. Raleigh has been appointed city engineer at Tacoma, Wash., succeeding Frank L. Davis, deceased.

Benno A. Wise has been elected city engineer at Bradford, Pa., to succeed A. F. Bannon, Jr., recently resigned.

W. M. Hunt has been appointed assistant city engineer, succeeding A. D. Ludlow, resigned, at Kansas City, Mo.

James R. Thompson, formerly city engineer at Mankato, Minn., has been elected president of the board of public works.

W. B. Bates has resigned as city engineer of Roanoke, Va., and will be associated with H. H. Hubbins, of that city.

Carleton H. Wells, president of the Texas Bitulithic Company, died at his home in Dallas, Texas., July 18, aged 44 years.

E. B. Black, formerly with the Riggs & Sherman Co., of Toledo, Ohio, has become a member of the J. S. Worley Company, engineers, of Kansas City, Mo.

Joseph M. Searle, who for a number of years has been engaged in consulting engineering work in Pittsburg, Pa., has been appointed smoke inspector of that city.

A. B. Bannon, Jr., former city engineer of Bradford, Pa., has been made superintendent of public works at Hornell, N. Y., succeeding Frederic Leach, deceased.

Morris R. Sherrerd, chief engineer of the department of public works, Newark, N. J., has been retained by the Passaic Valley Sewerage Commission as consulting engineer.

George H. Randall, city engineer of Oshkosh, Wis., read a paper at the eleventh annual convention of the League of Wisconsin Municipalities at Marinette, Wis., on "Bituminous Pavements."

George Campen, recently appointed assistant city engineer at Omaha, Neb., was formerly city engineer of Lincoln, Neb., for several years, and has recently been connected with the municipal engineering works in the Canal Zone.

Patrick J. Brennan, a prominent contractor of Washington, D. C., died August 10, after an illness of two weeks, aged 38 years. He was president and general manager of the Brennan Construction Company, which has been prominent in street paving and repair work in the District of Columbia.

W. J. Crocken, city engineer of East St. Louis, Ill., Wilford A. Thompson, Assoc. M. Am. Soc. C. E., and E. M. Crocken have formed a partnership for the practice of general civil engineering under the firm name of the East St. Louis Engineering Co., with offices in the Arcade Building, East St. Louis.

Edmund M. Blake has resigned as manager of the Idaho Irrigation Co., Ltd., and has established an office as consulting engineer in the Overland Building, Boise, Idaho. He will give his attention to the designing, construction, organization and management of engineering projects, specializing in water works, power plants and irrigation.

Henry G. Parker, assistant city engineer of Los Angeles, Cal., was drowned August 6 in the Los Angeles outfall sewer at Hyperion, near Redondo Beach, Cal., where he was supervising repairs to one of the flood gates of the sewer. Accompanied by the superintendent of the sewer, Mr. Parker had descended into a manhole about 1,000 feet from the point where the sewer enters the ocean. Both men were soon compelled by sewer gas to return to the surface, where Mr. Parker sat on the edge of the manhole with his feet hanging inside while resting before returning to work. He was talking of descending again into the manhole, when he suddenly pitched forward and fell 20 feet into the torrent of sewage. His body was carried into the sea, but floated and was recovered. Mr. Parker was 40 years of age.

N. D. Wortendyke, assistant city engineer at Jersey City, N. J., was run over by a wagon recently, breaking both of his legs.

Carleton Hoskins Wells, president of the Texas Bitulithic Company for the past five years, died in Dallas, Texas, recently. He has been active in railroad, sewer, water and street construction in Nebraska, Ohio, Indiana, Wisconsin and Massachusetts, and since 1904 for the Texas Bitulithic Company in the southwest, first in Shreveport, La., and later in Dallas.

Frank Miller, who for six years has been chief engineer of the Snare & Triest Co., New York City, and E. McLean Long, civil and consulting engineer, 220 Broadway, New York City, have formed a partnership, and will, under the firm name of Long & Miller, design, inspect and superintend all kinds of steel and masonry construction, foundations, mechanical equipment of buildings, land derricks and floating derricks, at 220 Broadway, New York City.

J. M. Bruns has been secured by the Waterloo Cement Machinery Corporation as superintendent of its shops at Waterloo, Iowa, where the well-known Polygon concrete mixer and sundry equipment and supplies for contractors are manufactured. Mr. Bruns was formerly connected with the Municipal Engineering and Contracting Company of Chicago, and has a great deal of experience as a designer of contractors' equipment, especially along the lines of concrete working machinery.

MACHINERY AND TRADE

Polygon Concrete Mixer.

The Waterloo Cement Machinery Corporation issue an elegant new sixty-four-page catalog of the Polygon concrete mixer and sundry contractors' equipment which they manufacture. It is a beautiful specimen of the printer's and engraver's arts, and very comprehensively portrays the excellent line of machinery which they manufacture, notably the Polygon concrete mixer.

The policy of the company since its organization and taking over the business of the Waterloo Cement Machinery Company last January has been to do things in a thoroughgoing manner. They have paid systematic and vigorous attention to the improvement of the mixer they manufacture, and the rapidly increasing use of the Polygon mixer among contractors throughout the country testifies that their efforts have not been in vain, and that the Polygon machine has taken the place it deserves among the foremost mixers upon the market to-day. Parties contemplating the purchase of a mixer will do well to write the Waterloo Cement Machinery Corporation, Waterloo, Iowa, for a copy of the catalog, which the company will be pleased to send.

Exhibits at National Good Roads Convention.

It is the intention of the National Good Roads Convention to have an exhibition of road-making material and machinery in the Central Armory of Cleveland during the convention, September 21, 22, 23.

Every effort possible will be made to give exhibitors a chance to show their goods to the best advantage.

It will be remembered that in Buffalo, last year, no exhibit of this kind permitted manufacturers to show their goods. A large number of manufacturers have made inquiries as to whether or not there would be an exhibit this year. They can be assured that there will be one, and it will be conducted in a most satisfactory manner.

Any information concerning the exhibit may be obtained from Mr. F. A. Pase, Chairman Demonstration Committee, 931 Williamson Bldg., or Mr. A. A. Grimes, Manager Exhibition, 931 Williamson Bldg., Cleveland, Ohio.

Municipal Castings.

The Humphrey Pipe and Foundry Co., Bellefontaine, O., make a specialty of castings for use in sewers and drains, and for other municipal purposes, including pipe for culverts and sewers. In their catalogue are shown three forms of curb inlets to sewers, weighing 115 to 200 pounds each, manhole rings and covers of 8 to 9 inch height and 300 to 400 pounds weight, gutter crossing plates of various standard sizes and weights with offer to make special sizes and shapes to order, fire cistern cover and ring, square and round sewer gratings and house cistern covers.

For ditches and drains there are several patterns of grating covers with high and low cones to reduce the danger of clogging of inlets by refuse to a minimum. These cones are made to fit sewer tile of all sizes from 5 to 24 inches diameter.

The city engineer will find good use for the monument cover for use in street intersections, a frustum of a cone to set around the monument, with an iron cover set at the level of the surface. A lamp hole cover is similar in appearance on the street, but probably somewhat smaller.

Special castings are made from drawings, and numerous special forms, such as hitching posts and weights, grate bar, etc., are carried in stock.

Automobile-Proof Roads.

The process of using a refined tar for the prevention of the formation of dust on macadam roads under automobile traffic has passed the debatable stage, and the only difference among road engineers now is as to some of the refinements of the process. Machines are now being imported for the spreading of the tar so as to save labor, and various counties and cities, no doubt, soon will be in possession of complete tarring apparatus, so that they can keep forces at work through the entire season.

Another field of study is presented in the choice of tar, and several engineers have published careful studies based on analyses of the proportion of bitumen in the material for the purpose of discovering which grade gives the best service under the varying conditions.

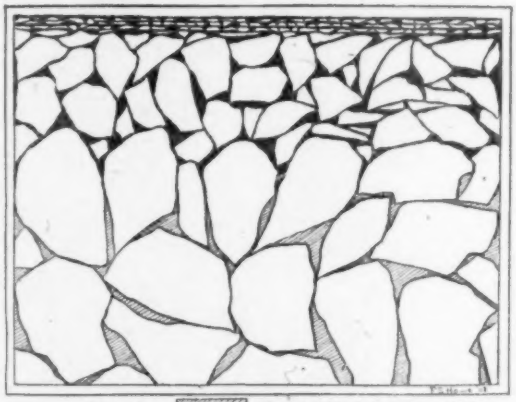
In this country, as elsewhere, it was early demonstrated that ordinary crude tar was not satisfactory for use on roads, because it varied so much in chemical character that uniformity of results could not be guaranteed. Tar taken from the same gas works would vary widely from day to day. A certain amount of refining was necessary, and this prepared coal tar has been standardized in America under the name of Tarvia, and the use of tar under this name frees the engineer from all trouble and responsibility in connection with difficult commercial analyses of the material.

For different types of work the density of the tarvia necessarily varies according to the size of the voids in the macadam. The mission of the tarvia is to fill all voids and solidify there to a plastic, rubber-like consistency, in which the stone is so firmly embedded that the automobile tires can not tear it loose. (See illustration.)

In building a new road the voids will, of course, be very large, and accordingly the very dense Tarvia X is used, a material of such weight and density that it will hold the stone and bridge the large spaces in the material.

For a road which is being resurfaced with fine stone screenings a tarvia of light consistency, namely, Tarvia A, is used. It will penetrate readily into the smaller interstices of the screenings where Tarvia X could not be made to percolate.

For an old road, where the interstices have been filled tight with dust, a still lighter grade of tarvia will be required, the material called Tarvia B, which can be used from a modified sprinkling cart and will soak into the fine pores of such a road and make a strong, durable bond.

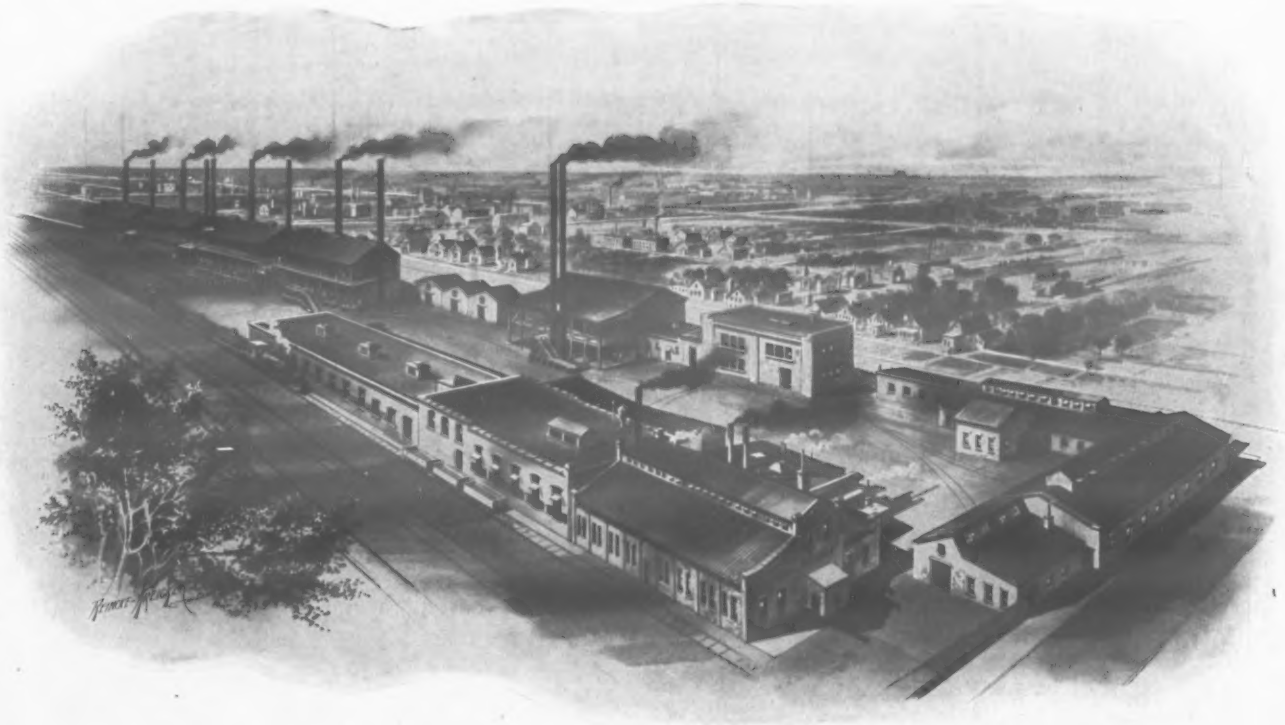


TARVIA FILLED MACADAM ON SAND FILLED BASE.

SECTION OF TARVIATED MACADAM PAVEMENT.

Tarvia B is, of course, the least expensive of the three applications. It requires only to be spread over the road like an oil, and expensive apparatus is not necessary. Tarvia A used with a new top layer of stone screenings is more effective because it goes deeper. Such application requires a steam roller and apparatus for heating as well as spreading the tarvia. It makes, however, a beautiful, smooth, durable road which resembles a sheet asphalt pavement in its appearance.

The Tarvia X treatment introduces the tarvia into the 1½-inch stone, and is still more thorough than the Tarvia A treatment. A road built with Tarvia X will retain its evenness of contour regardless of the wear on the top surface, and the maintenance of the road will for many years be confined solely to the top coat of fine screenings. The durability of this top



PLANT OF THE AMERICAN ASPHALTUM AND RUBBER COMPANY, GRAND CROSSING, ILL.

coat can also be greatly prolonged by the use of Tarvia A.

The ideal method, therefore, in which to build an economical macadam road is to use Tarvia X in the construction, and when, after a year or two, the surface begins to wear, to repair it with screenings combined with Tarvia A.

Tarvia will make the road semi-plastic, so that it yields slightly under the hammering of traffic, instead of pulverizing, as does the brittle plain macadam surface. In consequence the material that is put on the road stays there, being never pulverized by travel nor washed away by rain. The net result is large economies in maintenance.

It has been repeatedly demonstrated that it is actually cheaped to maintain a dustless tarviated road than a dusty untreated one.

Vitrified Paving Brick.

Vitrified paving brick is one of the only two products that showed an increase in 1908. This product increased from 876,245,000 in 1907 to 978,122,000 in 1908, a gain of 11.63 per cent., and in value from $9,654,282 in 1907 to $10,657,475 in 1908, a gain of 10.39 per cent. Ohio is the leading state for vitrified paving brick, reporting about one-third of the entire quantity and value.

Concrete Sewer Pipe for Denver, Colo.

Denver, Colo., is the latest large American city to adopt reinforced concrete pipe for sewers. The city has investigated the sewer pipe question, and has decided that it can save money by using the concrete product. Sizes from 24-inch to 72-inch will be used, and it is expected that about 19,000 feet will be laid at once.

Asphalt Plant of the American Asphaltum and Rubber Company.

Business in all lines is gradually returning to the equilibrium from which it was so rudely jolted a couple of years ago. This renewal of activity is as marked as it is encouraging, and it may fairly be said that in almost every line of industrial endeavor the dominant note voices the spirit of uplift, and that if prosperity has not returned, she is surely on the way.

As one instance among many which might be cited in proof of this, a striking example is offered by the recent movements of The American Asphaltum & Rubber Co., a Chicago industry whose operations practically ramify every state in the Union, while surplus energy is successfully carrying their product into foreign lands.

The present demand for the various materials manufactured by this company is particularly strong, due perhaps to a combination of favorable circumstances. Conspicuous among these gratifying conditions is the fact that The American Asphaltum & Rubber Co. own and control the mines from which are obtained the basic constituents of their principal products. These mines are located in Utah; the hydro-carbons and Gilsonite they yield have long been noted for their superiority, and as equally high grade materials can scarcely be obtained elsewhere, the prestige of the owners of these mines (as manufacturers) is apparent. Their structural and other paints, waterproofing asphalt, pipe coating, floor mastic, ready roofing and street paving asphalt are all firmly established staples, and for the past twelve years have been so recognized by engineers.

During the first half of the current year, trade indications, those substantial indications known as contracts, sales and orders, pointed to the necessity of increased facilities, and accordingly the manufacturing plant was enlarged and its daily capacity increased by 200 tons.

The illustration herewith is a bird's-eye view of this plant and warrants the claim that the American Asphaltum & Rubber Co., is one of the largest producers of asphaltic materials in the world. The shops are modern and all equipment, machinery and devices in every department are the latest improved.

The company maintains its own chemical laboratory, and constant watchful care is exercised for the maintenance of the high standards of its products.

The manufacturing plant is located at Grand Crossing, Ill., and the general offices occupy the greater part of the sixth floor of the Harvester building, 234 Michigan avenue, Chicago. The officers of the company are: J. F. Hill, president; H. Rawstron, vice president; H. F. Bunde, secretary and treasurer. A. J. Hill is general sales manager.

Trade Publications.

T. W. K. No. 2 is a leaflet of the Vulcanite Portland Cement Co., Flatiron Bldg., New York City, and Land Title Bldg., Philadelphia, which tells "Things Worth Knowing" about bonding new to old concrete.

A new booklet of the Sandusky Portland Cement Co., Sandusky, O., gives suggestions and applications of many everyday uses of cement and concrete, and is a very convenient little compilation of hints every cement user should be familiar with.

A new 5-inch transit for engineers and surveyors is shown in a leaflet of the Bausch & Lomb Optical Co., Rochester, N. Y.

Two of the recent booklets issued by the Indianapolis office of the Lehigh Portland Cement Co. are devoted to a large reinforced concrete building in Evansville, Ind., and to some new cement walks and driveways of unusual design. A third shows pictures of all the Lehigh factories, eleven in number.

The Barrett Manufacturing Co. issue a

booklet on "Road Preservation with Tarvia," containing N. P. Lewis's report on dust prevention in France and a statement of the uses of Tarvia A, B. and X.

A booklet of the Marquette Cement Mfg. Co., Marquette Bldg., Chicago, Ill., gives the specifications for the concrete street pavements recently constructed in Fond du Lac, Wis., and a number of Photographs of the work under construction and completed.

Bulletin 63 of the Universal Portland Cement Co., Chicago, Ill., is largely devoted to reinforced concrete buildings.

Bulletin 10, of the Association of American Portland Cement Manufacturers, Philadelphia, Pa., treats in detail of concrete surface finish.

The Sucro Filter Co. publishes a booklet on pure water by gravity filtration for every person and for every purpose.

A late circular of the American Asphaltum and Rubber Co., 600-610 Harvester Bldg., Chicago, Ill., quotes from various reports and specifications for coated steel and wooden pipe to show the value of the Pioneer mineral rubber pipe coating, earlier known as Assyrian asphalt, for this purpose. The coating has been in use for over twelve years and has been eminently successful in preventing rust and decay in pipes on which it has been used.

The B. F. Sturtevant Co. will send one of King's booklets describing the Pennsylvania railroad station in New York City.

Lincoln Bush, Consulting Engineering, New York, has published in pamphlet form two articles, one on the Bush trainshed built for the Chicago & Northwestern railroad in Chicago, and one on Bush track construction for the Delaware, Lackawanna & Western railroad in the Bergen Hill tunnel, New Jersey.

Adolphus Busch is the purchaser of the American Diesel Engine operating with safe crude or fuel oils.

The Worcester, Mass., Board of Trade issued a heart-shaped booklet for the excursion to the Seattle Exposition, which exploits the many and varied industries of the New England city. Copies will be sent to those interested by John L. Sewall, secretary.

The annual report of President Lee S. Smith, of the Chamber of Commerce of Pittsburg, shows that that organization is more than usually active in its good work for the development and improvement of the city.

The latest publication of the Trussed Concrete Steel Co., Detroit, Mich., is the third edition, revised and enlarged, of "A Hand Book of Practical Calculation and Application of Reinforced Concrete," giving the Kahn system standards.

Trade Notes.

ASPHALT.

Indianapolis, Ind.—The Peters Paving Co., South Dakota, has been incorporated here to do a general contracting and construction business, by Dupe Bates, Fred C. White, Thomas H. Robinson, L. E. Gaffey, and L. S. Stephens.

Kansas City, Mo.—A contract for the immediate installation of a municipal asphalt repair plant was awarded to a firm of Cleveland, Ohio., for $29,395.

Brooklyn, N. Y.—The Borough Asphalt Company has been incorporated to manufacture, vend and lay asphalt products here, by Harry F. Langhaus, of Bayonne, N. J.; Adam Seipel, 1260 Nelson ave., Bronx boro; Henry Wittel, Astoria, N. Y.

Little Rock, Ark.—The Sumption Paving Co., formerly of Conway, Ark., has entered actively into the business life of this city.

Indianapolis, Ind.—The Petrolithic Paving Co., has been incorporated here to do a general construction business, by M. M. DeFrees, Frederick B. DeFrees, and H. J. DeFrees.

Tacoma, Wash.—Commissioner McGregor has included in his budget for 1910 the sum of $15,000 for the erection of a municipal asphalt plant.

BRICK.

Schenectady, N. Y.—(Special). Robert J. Cordner, 23 High ave., advises us that he is considering the question of starting a company to make pressed brick, and desires prices on brick pressing machinery and cost of enamel brick and tile.

CEMENT.

La Salle, Ill.—The Marquette Cement Mfg. Co. is making extensive additions to its works.

CONCRETE BLOCKS.

Memphis, Tenn.—The Koehler Paving & Concrete Co. has been incorporated here by Paul Koehler, W. A. Percy, O. D. Fowler, A. D. Bellamy, and Allen Hughes.

Green Bay, Wis.—H. C. McIntyre and G. H. Mohr are considering the question of locating a brick plant at Beloit, Wis., for the manufacture of brick from cement and sand.

Indianapolis, Ind.—The Adamantine Concrete Brick Co., South Dakota, has been incorporated here to manufacture concrete brick, by August Burners, H. D. Phillips, and E. R. Templeton.

Brockton, Mass.—J. E. Ward, M. L. Harvey and C. G. Clapp have organized a company here to operate a concrete block plant.

Huntington, W. Va.—The Huntington Cement Block Co. has been incorporated here by L. J. Ashworth, R. L. Archer, F. S. Brown, and J. L. Stewart.

Brooklyn, N. Y.—The Excelsior Concrete Co. has been incorporated here to manufacture building materials, by John Campbell, C. S. Sherwood, and W. A. Thorn.

New Haven, Conn.—The New Haven Artificial Stone Co. has been incorporated to manufacture concrete blocks, by H. E. Warner, Jr., V. H. Anderson, and A. Mears.

Depew, N. Y.—(Special). Howard L. Meyer advises us that he is in the market for a power concrete block machine.

CONCRETE.

Wilkes-Barre, Pa.—About 700 concrete piles will be used in the foundations of the new high school building on North Washington st., by the Sax & Abbot Con-

struction Co. of Philadelphia, the general contractors. Owen McGlynn is the architect of the building.

New York City, Borough of Richmond.—Concrete piles will be used by Joseph Johnson's Sons, contractors, for supporting the sewer which they are constructing on Lyman ave. and Summit st.

Doylestown, Pa.—The reservoir of borough water supply will be lined with steel reinforced concrete and will be covered with the same material. The reservoir will be emptied Sept. 2 between 10 a. m. and 1 p. m. for inspection by prospective bidders, and bids will be received Sept. 9 at 8 p. m.

Cincinnati, O.—Concrete piles will be used in the foundations for the automobile building under construction for Haberer Bros., at Gest and Evans sts. Chas. H. Glandorf is the contractor and Albert Kuball is the architect.

Marshall, Tex.—The Waters-Pierce Oil Co. is rebuilding its buildings, which were recently destroyed by fire, with concrete.

PURCHASE OF MATERIALS.

Maysville, Ky.—(Special). August Schaeffer says that city may have to concrete two basins, aggregating 18,000 ft. and requiring one car-load of Portland cement, quick-setting, if possible.

Farmville, Va.—(Special). Thos. A. Bolling is in the market for expanded metal lath.

Connersville, Ind.—(Special). R. J. Greenwood desires to communicate with dealers in crushed stone for about 4,600-cu. yds. to be delivered at Falmouth, Ind., on J. M. & I. R. R., a branch of the Pennsylvania lines.

SEWER PIPE.

Spokane, Wash.—The Washington Brick, Lime & Mfg. Co. and the Spokane Sewer Pipe Co. have consolidated under the name of the Washington Brick, Lime & Sewer Pipe Co., with officers as follows: president and manager, Jos. H. Spear; vice-president, Wm. M. Colby, of Mason City, Ia.; secretary, S. J. Boal, of Minneapolis; treasurer, T. E. Redman, of Jackson, Mich.

Patents Concerning Earth Excavation and Removal.

848,076, 848,077. Dump Wagons, David S. Watson, Canastota, N. Y.

849,056. Dumping Wagon. Robert Critser and Robert C. Wright, Lapel, Ind.

849,067. Dumping Wagon. John Heberling, Rochester, N. Y.

853,275. Dump Wagon. Walter A. Underhill, Auburn, N. Y.

854,085. Dump Wagon. Chas. A. Geiger, Troy, O.

855,161. Dumping Wagon. Richard G. and Leon Castor, Palmyra, N. Y.

855,241. Dumping Wagon. Raymond S. C. Fow, Trenton, N. J.

855,762. Dumping Wagon. Edward K. Ernig, Ernigsville, Pa.

856,831. Dumping Wagon. Frank Aldrich, Detroit, Mich.

857,622. Bucket (Dumping). Noah M. Heller, Sharpsburg, Pa.

857,943. Dumping Wagon. Wm. J. Judd, Park Ridge, N. J.

859,928. Dumping Wagon. Wm. J. Donnelley, Dubois, Pa.

859,971. Dumping Wagon. Henry S. Palm, Reading, Pa.

860,994. Wheeled Scraper. Adam S. Rowsey, Helmville, Mont.

861,023. Dumping Wagon. Albert Flowers, Camden, O.

861,745. Hydraulic Dredging Apparatus. Jefferson D. Maxwell, Anderson, S. C.

862,184. Dumping Wagon. Jas. H. Murray, Lankin, N. D.

863,566. Dumping Wagon. Peter Blatt, Allegheny, Pa.

864,536. Dumping Wagon. John Heberling, Rochester, N. Y.

864,537. Dumping Wagon. Benjamin A. Hill, Chicago, Ill.

864,768. Dumping Wagon. Frank Bloomingdale, Voorheesville, N. Y.

865,049. Dumping Wagon. Abby C. Lemon, Roanoke, Va.

865,708. Dumping Wagon. Chas. Johnson, Auburn, N. Y.

866,578. Dumping Wagon. Solomon F. Brown, San Francisco, Cal.

866,717. Dumping Wagon. Geo. W. Crane, Veedersburg, Ind.

867,366. Dumping Wagon. John Heberling, Rochester, N. Y.

869,354. Grading Machine. Chas. D. Edwards, Albert Lea, Minn.

870,132. Dumping Wagon. Josiah M. Ripple, Martinsburg, W. Va.

870,929. Dumping Wagon. Arthur Cameron, Jackson, Mich.

871,012. Dump Wagon. David S. Watson, Elmer Bushnell and Jas. F. Sanderson, Canastota, N. Y.

871,091. Dumping Wagon. Reginald N. Lowry, Allegheny, Pa.

871,771. Dump Wagon. Wm. Atkins, Auburn, N. Y.

873,397. Dumping Wagon. Arthur L. Warner, Moline, Ill.

873,772. Dump Car. Thos. R. McKnight, Aurora, Ill.

873,814. Wagon Dump. John F. White, Bloomington, Ill.

875,487. Means for Causing an Automatic Scouring Action for the Removal of Silt from River Beds and Waterways. Edouard M. Audouin, Poitiers, France.

875,727. Dumping Wagon or Car. Edward C. North and Wm. L. Knapp, Palmyra, and Christopher H. Bierbaum, Buffalo, N. Y.

875,844. Flexible Joint for Dredger Pipes. Manuel R. Peacock, Oakland, Cal.

875,908. Dumping Wagon. John Heberling, Rochester, N. Y.

877,180. Dumping Wagon. Giovanni Dwiso, New York, N. Y.

877,338. Dump Wagon. Wm. H. Hull and Herbert B. Wright, Chicago, Ill.

877,884. Dump Wagon. Wilbur L. Collins, Baldwinsville, N. Y.

878,115. Dumping Cart. Benj. F. Brown, Bridgeton, Ind.

878,283. Grader and Excavator. Wm. F. Fink, La Jara, Colo.

878,687. Dumping Wagon. Edgar B. Symons, Ft. Wayne, Ind.

878,907. Dump Wagon. Joseph Stifler, Pittsburg, Pa.

879,478. Ditcher and Road Grader. Wm. Larkin, Barton, Ark.

879,607. Elevating Grader. Luke V. Brophy, Ft. Wayne, Ind.

879,826. Dump Cart. Ezra A. Mathes, Philadelphia, Pa.

879,970. Road Grader. John V. Kruse, Virginia, Ill.

880,054. Dumping Wagon. Jas. H. Van Arsdale, St. Louis, Mo.

880,643. Excavating Scraper. Jas. G. Fairbanks, Marion, O.

880,733. Dump Wagon. Joseph F. Hayes, Broad Brook, Conn.

882,358. Running Gear for Dump Wagons. Marquis J. Todd, Buffalo, N. Y.

887,225. Dump Wagon. Geo. A. Post, Chicago, Ill.

887,404. Dump Wagon. Henry F. Langreder, Chicago, Ill.

887,794. Dumping Wagon. Chas. M. Haeske, South Bend, Ind.
888,793. Dumping Wagon. John J. Enley, Philadelphia, Pa.
889,603. Dump Wagon. John W. Haywood, Baldwinsville, N. Y.
889,975. Apparatus for Thawing Frozen Ground, Etc. Chas. Schweiger, Maplewood, Mass.
890,318. Dumping Wagon. Hiram H. Walsh, Little Ferry, N. J.
890,791. Trench Excavator. Geo. W. Parsons, Newton, Iowa.
890,796. Road Grading Machine. Robert C. Redpath, Olathe, Kan.
892,268. Dumping Cart. Harry T. Kingsbury, Keene, N. H.
893,937. Wagon Box. Joseph B. Pospeshil, Detroit, Mich.
894,003. Dumping Wagon. Joseph W. Hobson, Bayonne, N. J.
896,404. Dumping Wagon. Williard O. Long, Mansfield, O.
898,336. Trench Brace. Murrell R. De France and Albert E. Read, Bellevue, Pa.
898,421. Combined Scraper and Drag. Wm. L. Baker, Indianapolis, Ind.
898,533. Dumping Wagon. Chas. H. Van Deusen, Verona, Ill.
899,011. Dump Wagon. John W. Haywood, Baldwinsville, N. Y.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Wellington, Kas.—An injunction will be filed restraining the Kaw Paving Co., of Topeka, Kas., from carrying out its contract recently made for constructing 19 blocks of asphalt paving in this city, according to local press reports.

CONTEMPLATED WORK.

Saginaw, Mich.—Owen st. will be paved during 1910.
Bellingham, Wash.—Young st. is to be paved with asphalt.
Kewanee, Ill.—Brick paving is contemplated. A. McLean, mayor.
Ashland, Ore.—Paving is contemplated for Mill st. in the near future.
The Dalles, Ore.—Bitulithic paving is contemplated for 2nd st.
New Orleans, La.—A petition has been filed asking that Milan ave. be repaved.
Spokane, Wash.—Plans have been completed for paving Division st. with asphalt.
Rensselaer, N. Y.—The city council has decided to pave Harrison ave. and 2nd st.
Grand Rapids, Wis.—Council has decided to issue $15,000 bonds for street improvements.
Sandpoint, Idaho.—This city has voted to issue $10,000 for street improvement purposes.
Mankato, Minn.—About 1-mi. of cement curb and gutter is contemplated. John Wilson, cy. engr.
San Diego, Cal.—The county voted to issue $1,250,000 bonds for constructing 450-mis. of highways.
Rock Island, Ill.—Plans are being prepared for paving 27th st. with brick. H. C. Meyer, mayor.
Indianapolis, Ind.—Resolutions have been adopted for paving Washington boulevard and 2 alleys with permanent material.
Hammond, Ind.—Plans are being prepared for constructing 1,000-sq. yds. of brick paving. Peter J. Lyons, cy. engr.
Riverside, Cal.—Preliminary surveys are being made for constructing 8-mis. of the Banning-Idlewild road. Co. surv.
Long Branch, N. J.—Plans and specifications have been accepted for constructing about 3-mis. of gravel road. Co bd.
San Francisco, Cal.—This city has decided to appropriate $34,000 towards the construction and paving of San Bruno ave. Marsden Manson, cy. engr.
St. Albans, Vt.—City council has voted to construct concrete curbing around the park and in Fairfield ave. and to macadamize Brown ave.
Muncie, Ind.—A resolution has been adopted to grade and pave with cement, asphalt or bitulithic, an alley. John O. Potter, cy. Engr.
St. Joseph, Mo.—The property owners in Michigan ave. have petitioned the county court to macadamize that thoroughfare for a distance of about 3-mis.
Willimantic, Conn.—Plans and specifications are to be prepared for a system of sidewalks in this city, which is to include several blocks in the business section.
Quincy, Ill.—Ordinances have been passed for paving 10th and 11th sts. with brick blocks, aggregating 23,437-sq. yds. and 11,128-ft. of sandstone curbing, asphalt fill. F. L. Hancock, cy. engr.
Newark, N. J.—The repaving of S. Canal st. with granite blocks is contemplated. Ordinances have been passed for paving Bloomfield ave. with granite blocks, Brinsmade Place with bitulithic, and Durand st. with brick.
Parsons, Kans.—Plans are being prepared for constructing 6 blocks of concrete curb and gutter, and for paving Main and Washington sts. Macadam paving is also contemplated for 15th and Broadway sts. T. B. Wheat, cy. clk.

CONTRACTS TO BE LET.

Akron, O.—Bids are asked until Sept. 2 for grading and macadamizing roads Co. comrs.
Niagara Falls, N. Y.—Bids are asked until Sept. 7 for paving Little 4th st. B. P. W.
Muncie, Ind.—Bids are asked until Sept. 8 for improving highways. Jos. E. Davis, co. audt.
Wabash, Ind.—Bids are asked until Sept. 7 for constructing a gravel road. J. P. Noftzger, co. audt.

There is an apparent discrepancy

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or the pagination is incorrect.

e book is found in the collections.

Sept. 16 for constructing a ditch 27-mis. long. Joint drainage bd; Wright, Hamilton and Hardin counties.

Waukesha, Wis.—Bids are asked until Sept. 3 for constructing house drains, water service connections, etc., in several streets. John P. Dey, chmn. B. P. W.

Columbus, O.—Bids are asked until Sept. 8 for constructing sewers and drains in the Ohio State University grounds. Carl E. Steeb, secy. bd. trustees Ohio State University.

Huntington, Pa.—Bids are asked until Sept. 6 for constructing a sewage disposal plant and storm water sewers at the Penn. Industrial Reformatory. T. B. Patton, genl. supt.

Orillia, Ont.—Bids are asked until Sept. 9 for constructing sanitary sewers, sewage station, sewage pumping machinery, force main and about 7,000-ft. of iron pipe.

New York City.—Bids are asked until Sept. 7 for constructing outlet sewers in White Plains road, E. 152nd st., Avenue B and E. 156th st. Louis B. Haffen, prest. Bronx boro.

Columbus, O.—Bids are asked until Sept. 10 for sewer installation in 150 cells, constructing a brick power house, a water softening plant and 4 water tube boilers. Geo. U. Marvin, secy. bd. mgrs. Ohio Penitentiary.

Louisville, Ky.—Bids are asked until Sept. 3 for constructing a sewer in Dumesnil st. Bids are asked until Sept. 24 for constructing sections B-1, B-2, C and D of the Northwestern sewer, contracts Nos. 53, 54, 55 and 48. W. C. Nones, chmn. sewer comrs.

CONTRACTS AWARDED.

Seattle, Wash.—A contract for constructing a large sewer was awarded to Dan McCarry.

Carthage, Mo.—Frank I Taylor was awarded the contract for constructing a sewer for $1,467.70.

Wheeling, W. Va.—The contract for constructing a sewerage system was awarded to Coss & Meyer.

Kent, Wash.—The contract for constructing a sewerage system was awarded to L. Y. Stayton for $18,929.

Kearney, N. J.—The contract for constructing a sewer in Forest st. was awarded to Wm. C. Green, for $1,014.

Emsley, Ala.—The contract for sewer extention was awarded to C. M. Burkhalter, of Birmingham, Ala., for $31,500.

Lafayette, Ind.—Wm. F. Frey was awarded the contract for constructing a sewer in Alabama st., Aug. 11, for $7,748.

Binghamton, N. Y.—John Tyne was awarded the contract for constructing a storm water sewer in Main st., for $6,366.

Bloomington, Ill.—P. McDonald was awarded a contract for constructing sewers in Wright and Clay sts., for $1,884.48.

Ashtabula, O.—The contract for constructing sewers in Depot and Ann sts. was awarded to J. T. Clark, for $4,410.50.

Monticello, Ark.—The contract for constructing sewers was awarded to Gleen & Rich, of Webb City, Mo.

Boston, Mass.—T. J. Young & Co. secured the contract for constructing a sewer in Washington st., West Roxbury, for $7,906.83.

Hancock, Mich.— The contract for constructing a sewer in Montezuma st. was awarded to Phil. O. Sheridan, for $2,254.50.

Monroe, La.—The contract for constructing a drainage canal from 11th st. to the river was awarded to A. Skoog, for $14,651.

Little Rock, Ark.—Joseph McCoppin was awarded the contract, Aug. 17, for constructing a sewer in dist. No. 52, for $8,740.75.

Louisville, Ky.—The contract for constructing a sewer in Ewing ave. was awarded to M. J. Burke, of Sandusky, O., for about $25,000.

Little Rock, Ark.—The contract for constructing a sewer in dist. No. 53 was awarded, Aug. 17, to Joseph McCoppin, for $8,740.75.

Elizabeth, N. J.—The contract for constructing a trunk sewer to relieve the Elizabeth river was awarded to Wm. J. McCloud, for $225,000.

Hamilton, O.—Louis Drach & Co., of Cincinnati, have been awarded the contract for constructing a sewer in East ave., for $9,195.33.

Prophetstown, Ill.—The contract for constructing a new sewerage system was awarded to Dearborn & Jackson, of Cedar Rapids, Ia., for $8,229.

Everett, Wash.—The Everett Construction Co. was awarded the contract for constructing a sewer in the northwest part of the city for $27,974.

Louisville, Ky.—The contract for constructing the western intercepter sewer was awarded to T. B. Jones & Co., of St. Louis, for about $50,000.

Winston-Salem, N. C.—The Winston Mill Supply Co. was awarded the contract for constructing about 2,600-ft. of sewer in the new southwest sewer district.

Medfield, Mass.—A contract for enlarging the filter beds at the Medfield Insane Asylum was awarded to Michael Little & Co., of Leominster, for $9,375.

St. Albans, Vt.—A contract for furnishing pipe for the new trunk line sewer was awarded to the American Sewer Pipe Co., of Philadelphia, for $12,558.51.

Elizabeth, N. J.—B. H. Brooke & Co., 50 Church st., N. Y. City, was awarded the contract for constructing a pumping station for the new intercepting sewer, for $12,835.

Cincinnati, O.—Sewer contracts were awarded as follows, Aug. 5: Glenway and Grand aves., Thos. P. Strack, $14,453; Seegar and Vinton sts., Connelly Construction Co., $7,643.

Hamilton, O.—W. H. Louthan has been awarded the contract for constructing a sanitary sewer in Hanover st. and a sanitary sewer and house connections in East ave. for $7,119.

Xenia, O.—The contract for constructing a sewage disposal plant at the Ohio Soldiers' & Sailors' Home was awarded, Aug. 21, to the General Cement Co., of Cleveland, for $13,307.25.

Olean, N. Y.—Kuhn & Applegate secured the contract, Aug. 10, for constructing 2.4-mis. of outlet sewer in the 8th ward, and an additional outlet in the 1st, 4th and 5th wards, for $14,565.

Des Moines, Ia.—The J. W. Turner Imprvt. Co. submitted the lowest bid for constructing a sewer in Woodland ave., at $2.14⅞ a lin. ft. O. P. Herrick was the lowest bidder for a sewer system in Euclid ave. at $1.48 a lin. ft.

San Francisco, Cal.—The Coast Construction Co. was awarded a contract, Aug. 12, for constructing sewers in the Bay View and Silver Terrace districts, for about $78,000, and the Healy-Tibbitts Constr. Co. secured the contract, Aug. 13, for the North Beach intercepting sewer, for $86,780.

Albert Lea, Minn.—(Special). Wm. Barneck, cy. engr., says the contract for constructing a trunk sewer was awarded, Aug. 19, to Tanner Bros., of Minneapolis, for $23,980.05. The other bidders were as follows: Helmer & Eitel, Minne-

apolis, $24,360; J. W. Turner Impvt. Co., Des Moines, Ia., $28,459; Cook Construction Co., $26,334; Ilstrup & Olson, Minneapolis, $27,730.30; Frazer & Danforth, Rochester, Minn., $28,563.85.

WATER WORKS.

Knoxville, Tenn.—The city council voted to purchase the plant of the Knoxville Water Co. for $1,250,000.

Clarksburg, W. Va.—The Broad Oaks Development Co. has been incorporated to construct a water-works system at Broad Oaks, by J. M. Coffman, C. W. Halterman, and others of this city.

Birmingham, Ala.—A company has been organized and incorporated by citizens of this city for the purpose of building a new system of dams at the junction of the Sipsey and Mulberry forks of the Black Warrior river and bringing water from Walker to this city. W. L. Friel, Chas. E. Glover, S. W. Hawkins and T. H. Friel are the incorporators.

CONTEMPLATED WORK.

Drain, Ore.—A water-works system is contemplated.

Albany, Wis.—A water-works system is contemplated.

Quanah, Tex.—Voted to issue $30,000 additional water-works bonds.

Ralston, Okla.—Voted to issue bonds for constructing water-works.

Weston, Ore.—Voted to issue bonds for constructing a water-works system.

Cold Springs, Minn.—Voted to issue bonds for constructing a water-works system.

Fairview, Mass.—A new pumping station is contemplated. F. A. Cobb, cy. engr.

Freewater, Ore.—The city council has decided to install a water-works system.

Pratt City, Ala.—Voted to issue bonds for constructing a water-works system.

Warren, O.—Will vote on the issue of bonds for constructing a water-works system.

Asotin, Wash.—Will vote on the issue of bonds for constructing a water-works system.

Cuthbert, Ga.—Will vote in October on the issue of bonds for constructing water-works.

Woodward, Ia.—Will vote Sept. 6 on the issue of bonds for constructing a water-works system.

Valley, Neb.—Voted to issue bonds for installing a water-works and electric light system.

Grand Rapids, Wis.—The common council has decided to issue $20,000 bonds for water-works improvements and extension.

Hancock, Mich.—Plans for constructing a city water cistern in West Hancock have been submitted by city engr. Craig.

Coeburn, Va.—The Coeburn Light & Power Co. contemplates the instllation of a water-works and iceplant.

Madison, Ind.—Bids will be asked for soon for improving the city water plan, including sinking from 2 to 8 wells.

Manistee, Mich.—Plans for the improvement and extension of the water-works system will be prepared by John W. Alvord, of Chicago.

Jackson, Mich.—The estimated cost of installing a filtration system at the water-works is $100,000. Hamilton Johnson, mgr. w. w.

Toyah, Tex.—The Commercial Club is considering a proposition made by F. C. Billingslea, to construct a complete water-works system for this city.

Middletown, Conn.—The construction of a storage reservoir is recommended by Samuel McKenzie, of Southington, in his report to the water commissioners.

Pittsfield, Mass.—Cy. engr. Farnham estimates the cost of the proposed water main from Silver Lake to North st. at $50,000, and with electrical pumps at $60,000.

Batesville, Miss.—Plans and specifications will be prepared for constructing a water-works system, by Xavier A. Kramer, of Magnolia, Miss., who will also supervise the work of construction.

Johnson City, Tenn.—The city council rejected, Aug. 9, the offer of the Watauga Water Co. to sell its plant for $245,000, and an election will be held Sept. 11 to vote on the issue of bonds for constructing a municipal water-works system.

Kenosha, Wis.—The Simmons Mfg. Co. has made a proposition to the water commissioner, offering to purchase the present intake as a water supply for the Simmons factory and to pay the city $10,000 for it.

Auburn, N. Y.—(Special). The water board has determined, after an exhaustive research and report by Hazen & Whipple, to build a slow sand filtration plant. Hazen & Whipple have been directed to prepare the plans for the same, and bids will probably be asked late this fall or early in the winter. J. Walter Ackman, supt. bd. and resident engr. in ch. of construction.

CONTRACTS TO BE LET.

Macon, Miss.—Bids are asked until Sept. 8 for remodeling the water-works and electric light plants.

Marietta, Ga.—Bids are asked until Sept. 20 for constructing a water-works system. Bd. water comrs.

South Milwaukee, Wis.—Bids are asked until Sept. 7 for installing a filter plant. Wm. G. O'Neill, cy. clk.

Red Wing, Minn.—Bids are asked until Sept. 15 for constructing a water-works system. A. E. Rhance, cy. engr.

Carthage, Mo.—Bids are asked until Sept. 3 for constructing a concrete reservoir. W. A. Turner, sec'y B. P. W.

Vicksburg, Miss.—Bids are asked until Sept. 6 for constructing a water main in Cherry st. J. J. Hayes, mayor.

Toronto, Ont.—Bids are asked until Oct. 14 for furnishing turbine pumps, with valves, piping, bedplates, etc. Cy. engr.

Bloomington, Ill.—Bids are asked until Sept. 2 for constructing 20, 12 and 10-in. c. i. water mains in Division, Lee and other streets. Cy. engr. Folsom.

Henryetta, Okla.—Bids are asked until Sept. 9 for constructing a water-works system. W. R. Davis, secy. lgt. & water comrs.

Detroit, Mich.—Bids are asked until Sept. 14 for constructing 3 pumping engines at the pumping station. Benj. F. Guiney, sec'y. bd. water comrs.

Hartshorne, Okla.—Bids are asked until Sept. 13 for constructing a water-works system and a sanitary sewer system. F. C. Savage, mayor.

Smithfield, N. C.—Bids are asked until Sept. 6 for constructing a water-works system for the court house and jail. Sam T. Honeycutt, clk. co. comrs.

Newburgh, N. Y.—Bids are asked until Sept. 13 for raising an earth dam and roadway, building concrete masonry, stone rip-rap walls and slope paving, etc. Curtis Stanton, supt.

Montreal, Que.—Bids are asked until Sept. 14 for the enlargement of the city's aqueduct by widening and deepening the dam. Geo. Janin, supt. & ch. engr. w. w.

Cleveland, O.—Bids are asked until Sept. 2 for constructing water mains in Schaaf and Bradley roads and W. 11th st. H. F. Chester, vil. clk., Brooklyn Heights.

Doylestown, Pa.—Bids are asked until Sept. 9 for relining, elevating and covering the present reservoir with steel reinforced concrete. A. Harry Clayton, boro clk.

Richmond, Va.—Bids are asked until Sept. 14 for furnishing gate valves, c. i. pipe, special castings, fire hydrants, valve boxes, etc. E. E. Davis, supt. w. w.

Lamar, Colo.—Bids are asked until Sept. 5 for constructing an earth-filled dam with concrete or puddled core, tunnels, outlet work, main canal and distributing system. Two Buttes Irrigation & Reservoir Co., Lamar.

Christiansburg, Va.—Bids are asked until Sept. 8 for furnishing 6-mis. of 10, 8, 6 and 4-in. c. i. pumping and distributing mains, with special castings and valves and about 46 fire hydrants. John R. Johnson, chmn. special water com.

High Point, N. C.—Bids are asked until Sept. 15 for building a reinforced concrete coagulating basin, a filter plant, clear water basin and accessories, laying 1,600-ft. of sewer pipe and constructing a concrete septic tank. Gilbert C. White, engr., Durham, N. C.

CONTRACTS AWARDED.

Towson, Md.—A franchise has been granted to the Aigburth Well Co., of Towson, for laying water mains.

Dickinson, N. D.—The contract for water extensions was awarded to the Dickinson Heating & Plumbing Co., for $6,250.

Boise, Idaho.—South Boise has granted a franchise to Edmund M. Blake and associates to install a water-works system.

Antioch, Ill.—Wm. Davidson, of Wilmette, was awarded the contract for laying 8,000-ft. of water main, Aug. 11, for $6,680.

Wheeling, W. Va.—The Allis-Chalmers Co., of Milwaukee, Wis., was awarded the contract for installing a pump for $140,000.

Clyman, Wis.—The contract for constructing a water-works system was awarded to E. A. Mendenhall, of Watertown, for $4,000.

Covington, Ky.—The contract for flushing the water pipes was awarded, Aug. 14, to the National Pipe Cleaning Co., of New York.

North Attleboro, Mass.—The contract for constructing filter beds here was awarded to Trumbull & Co., of Boston, for $28,137.

Glasgow, Mont.—The contract for constructing a water-works system was awarded, Aug. 11, to Jas. Kennedy, of Fargo, N. D., for $53,789.

Gardner, Mass.—John E. Palmer, O'd South Bldg., Boston, was awarded the contract for laying c .i. water pipe at the Gardner State Colony.

Puyallup, Wash.—Nevins & Cline secured the contract, Aug. 11, for furnishing and laying water mains in the business section, for $2,525.60.

Perry, Ga.—The contract for constructing a water-works system was awarded to the General Contracting & Construction Co., of Atlanta, Ga., for $14,517.

Chester, Pa.—W. B. Campbell was awarded the contract for excavating and hauling away earth from clear water and settling basin to be constructed in the West End.

Marcellus, N. Y.—A contract for constructing 7,000-lin. ft. of 6-in. c. i. pipe, 1,900-ft. 4-in. pipe, etc., was awarded to Samuel Bonn, 654 Bonn ave., Syracuse, N. Y.

Washington, D. C.—The Glamorgan Pipe & Foundry Co., Lynchburg, Va., was awarded the contract for furnishing 200 fire hydrants for the District of Columbia, at $34.20 each.

Norwalk, O.—Contracts for constructing 2,130-ft. of water mains in N. Foster ave. were awarded to Chas. G. Pinell, for $1,773.30, and in Manhattan ave, to Geo. Sellinger, for $991.40.

Lock Haven, Pa.—The contract for furnishing $3,500-ft. of 18-in. c. i. pipe for the extension to McElhattan run was awarded to John Fox & Co., of New York City at $23 per ton.

Elkhorn, Neb.—Contracts for constructing a water-works system have been awarded as follows: construction, National Co. of South Bend, Ind.; engines and pumps, Fairbanks & Morse Co., of Omaha; total price, $8,500.

Bloomington, Ill.—Contracts for constructing water mains have been awarded as follows: Madison and Union sts., Frank Sullivan, $1,903.96; Beecher st., Ross Johnson Co., $901.50; Wood st., R. R. McGregor, $999.46.

Lamar, Colo.—The contract for constructing a water-works system was awarded, Aug. 11, to Spicer & Baldwin, of Colorado Springs, for laying pipe, for $29,100, and to Manville & Fillon, of Lamar, for constructing a concrete reservoir, etc., for $19,500.

New Bedford, Mass.—Contracts for furnishing c. i. water pipe and special castings were awarded Aug. 17, as follows: Warren Foundry & Machine Co., of Phillipsburg, N. J., 5,903-tons pipe, $23 per ton; 220-tons special castings, $47.50; total, $146,219. Standard Cast Iron Pipe & Foundry Co., Bristol, Pa., 610-tons of pipe, $23.15 per ton; 20-tons special castings, $46 per ton; total, $15,041.

BRIDGES.

Cleveland, O.—Bids are asked until Sept. 8 for constructing a bridge. Wm. F. Black, clk. co. comrs.

Brazil, Ind.—Bids are asked until Sept. 7 for constructing a steel bridge. J. L. Burnes, co. audt.

Greensburg, Ind.—Bids are asked until Sept. 6 for repairing several bridges. F. E. Ryan, co. audt.

Faulkton, S. D.—Bids are asked until Sept. 7 for constructing bridges. W. H. Race, co. audt.

Columbus, Ind.—Bids are asked until Sept. 6 for constructing and repairing bridges. J. M. Davis, co. audt.

Newport, Ind.—Bids are asked until Sept. 6 for repairing Skinner bridge. H. T. Payne, co. audt.

West Point, Miss.—Bids are asked until Sept. 6 for constructing 4 bridges. L. J. Howard, clk comrs.

Shelbyville, Ind.—Bids are asked until Sept. 6 for building 10 new concrete arch culverts in 5 twps. Bd. comrs.

Sandusky, O.—Bids are asked until Sept. 3 for constructing a bridge over Pipe creek. Chas. Kubach, co. aud.

Lancaster, O.—Bids are asked until Sept. 10 for constructing approaches to "Bishop" run bridge. Palmer Howard, co. audt.

Phoenix, Ariz.—Bids are asked until Sept. 7 for designs, plans, etc., for a bridge over Salt river. Bd. supvrs.

Doylestown, Pa.—Bids are asked until Sept. 13 for constructing a new concrete bridge at Jacksonville. Co. comrs.

Hazelhurst, Miss.—New bids will be

asked in September for constructing a steel bridge over Pearl river. Bd. supvrs.

Jacksonville, Fla.—Bids are asked until Sept. 10 for constructing a steel bridge over Julington creek. Co. comrs.

Akron, O.—Bids are asked until Sept. 13 for constructing 2 bridges at Barberton, O. Chas. L. Wirth, clk. co. comrs.

Wytheville, Va.—Bids are asked until Sept. 6 for building a bridge over Reed creek. John B. Hurt, co. clk.

Chicago, Ill.—Bids are asked until Sept. 8 for constructing highway bridges. I. J. Bryan, clk. bd. trustees sanitary district.

Streator, Ill.—Bids are asked until Sept. 6 for constructing a reinforced concrete bridge. John B. Patterson, cy. clk.

Logansport, Ind.—Bids are asked until Sept. 8 for repairing a bridge across Wabash river at Georgetown. Geo. W. Cann, co. audt.

Oliversburg, O.—Bids are asked until Sept. 7 for constructing a concrete bridge over Whetstone creek. Geo. H. Weidner, co. audt.

Vevay, Ind.—Bids are asked until Sept. 6 for constructing an iron bridge over Long Run creek. Scott Culbertson, co. audt.

Green River, Utah.—Bids are asked until Sept. 11 for constructing a bridge across Green river. Mark Tuttle, secy. Joint Bd.

Pala, Cal.—Bids are asked until Sept. 8 for building a bridge over San Luis river. Philip T. Lonergan, supt. U. S. Reservation.

Mercer, Cal.—Bids are asked until Sept. 21 for constructing a steel bridge over Merced river. P. J. Thornton, clk. bd. co. supvrs.

Joliet, Ill.—Bids are asked until Sept. 15 for constructing a concrete and steel viaduct at Jackson st. Arthur Montzheimer, engr.

Findlay, O.—Bids are asked until Sept. 7 for constructing a reinforced concrete bridge across Portage creek. John A. Sutton, co. audt.

Phoenix, Ariz.—Bids are asked until Sept. 7 for building a bridge across Salt river, of concrete reinforced with steel. Bd. supvrs.

Umatilla Reservation, Ore.—Bids are asked until Sept. 23 for constructing a bridge. F. H. Abbott, acting comr. Indian Affairs, Washington, D. C.

Clear Lake, S. D.—Bids are asked until Sept. 7 for constructing a steel bridge on cement foundation, and a wooden bridge. G. E. Force, co. audt.

Cincinnati, O.—Bids are asked until Sept. 10 for constructing a culvert under bridge on W. Miami river road. Stanley Struble, prest. co. comrs.

Zanesville, O.—Bids are asked until Sept. 13 for building the steel superstructure of a highway bridge over Brush creek in Stovertown. L. E. Breisford, co. audt.

Mercer, Pa.—Bids are asked until Sept. 3 for constructing a reinforced concrete bridge over Saul's Run, and for abutments to new bridges on Middlesex and Pulaski road in Shenango twp. John A. McGrath, clk. co. comrs.

STREET LIGHTING.

Melrose, Cal.—A municipal electric light plant is contemplated.

Marion, Ind.—Bids will be asked soon for erecting and equipping an electric light plant.

St. Johns, Kas.—Bids will be received about Sept. 15 for constructing an electric light plant.

Willimansett, Mass.—The citizens are agitating the question of installing an electric light plant.

Portales, N. Mex.—Bids will be received about Sept. 15 for constructing an electric light plant. H. H. Ryther, cy. clk.

Orange, N. J.—Bids are asked until Sept. 20 for constructing a municipal electric light plant. Arthur B. Seymour, mayor.

Irvington, N. J.—Bids are asked until Sept. 7 for installing a municipal electric light plant. M. Stockmon, town clk.

Cuthbert, Ga.—Will vote in October on the issue of bonds for improvement to the electric light, water-works and sewerage systems.

Boston, Mass.—The contract for constructing a new plant for the Plymouth County Gas Co. was awarded to a firm of Ft. Wayne, Ind.

New Albany, Ind.—Bids are asked until Oct. 20 for lighting the streets with electricity for 10 yrs. ; also lighting alleys. John C. Short, cy. clk.

Wichita, Kas.—The Capital Hill Gas & Electric Mfg. & Supply Co. has been incorporated by A. W. Aubrey, W. L. Harmon, of Capital Hill, and D. F. Sullivan, of Oklahoma City.

Toronto, Ont.—Bids are asked until Oct. 14 for furnishing 4 1,500, 4 500 and 2 225-h.p. synchronous motors; 2 1,500 and 4 500 h.p. induction motors, with exciters, switchboards, etc. Cy engr.

Berlin, Md.—(Special). Muralt & Co., engineers, of New York City, have been awarded the contract for furnishing and installing the electrical equipment of the new municipal lighting and pumping plant. Power will be generated and transmitted throughout the city by means of a 2,200-volt, two-phase alternating current system. The alternators will be of the belted type and will be driven by gas engines supplied by producer gas. Step-down transformers reducing the line potential to 110 volts will be provided at the centers of distribution from which the city lighting circuits will be fed.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Peoria, Ill.—Mayor Woodruff favors the construction of a garbage crematory.

Fort Thomas, Ky.—Bids are asked until Sept. 10 for constructing a garbage crematory here. Capt. John H. Wholley, constr. Q. M.

Fort Hamilton, N. Y.—Bids are asked until Sept. 16 for constructing a garbage crematory here, and Ft. Wadsworth. Constr. Q. M.

Pittsburg, Pa.—Plans have been completed for the proposed construction of 3 incinerating plants. John F. O'Toole, supt. bureau of highways & sewers.

FIRE APPARATUS.

Oil City, Pa.—Bids are asked until Sept. 13 for furnishing an auto fire truck. C. W. Mullalley, cy. controller.

Vincennes, Ind.—The Webb Motor Fire Apparatus Co. has awarded a contract for 50 Thomas automobiles to be used in the construction of fire fighting apparatus manufactured by that company. The autos are to be of special design, constructed especially for the Webb company, each costing $3,000 or a total of $150,000. The company purchases the Thomas car and then equips it with fire fighting machinery.

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Peru, Ind.—Bids are asked until Sept. 7 for constructing 2 gravel roads. Chas. Griswold, co. audt.

Winamac, Ind.—Bids are asked until Sept. 8 for improving highways. Ellis T. Rees, co. audt.

Delphi, Ind.—Bids are asked until Sept. 6 for constructing gravel roads. M. G. Haun, co. audt.

Westfield, N. J.—Bids are asked until Sept. 7 for improving Prospect st. Lloyd Thompson, town clk.

Tipton, Ind.—Bids are asked until Sept. 6 for constructing a gravel road. J. F. Barlow, co. audt.

Toledo, O.—Bids are asked until Sept. 7 for repairing Lewis ave. stone road. D. Davies, Jr., co. audt.

Bloomington, Ind.—Bids are asked until Sept. 10 for improving highways. Horace Blakely, co. audt.

Bluffton, Ind.—Bids are asked until Sept. 8 for constructing stone roads. O. D. Garrett, co. audt.

Upper Sandusky, O.—Bids are asked until Sept. 2 for constructing a road. J. N. Traxler, co. audt.

Williamsport, Ind.—Bids are asked until Sept. 7 for constructing a gravel road. Robt. L. Winks, co. audt.

Cincinnati, O.—Bids are asked until Sept. 10 for oiling Reding pike. Stanley Struble, prest. B. P. S.

Rockville, Ind.—Bids are asked until Sept. 7 for constructing gravel roads. H. A. Henderson, co. audt.

Gallatin, Pa.—Bids are asked until Sept. 2 for 8,500-sq. yds. of brick paving. D. Dilliman, boro engr.

Vincennes, Ind.—Bids are asked until Sept. 7 for constructing a gravel road. John T. Scott, co. audt.

Frankfort, Ind.—Bids are asked until Sept. 9 for constructing 14 gravel roads. Chas. F. Cromwell, co. audt.

Pine Creek, Minn.—Bids are asked until Sept. 4 for grading 2-mis. of road. A. J. Gilseth, clk. town of Dieter.

Atlantic City, N. J.—Bids are asked until Sept. 8 for grading and paving Shore Road. E. D. Rightmire, co. engr.

Fowler, Ind.—Bids are asked until Sept. 7 for constructing 6 crushed stone roads. Lemuel Shipman, co. audt.

Brookville, Ind.—Bids are asked until Sept. 6 for constructing a public highway. Chas. A. Miller, co. audt.

Kentland, Ind.—Bids are asked until Sept. 7 for constructing a macadam road. Elmer R. Bringham, co. audt.

Mountain Lake, Minn.—Bids are asked until Sept. 2, at 7:30 p. m., for constructing a sidewalk. J. H. Dickman, vil. clk.

Troy, O.—Bids are asked until Sept. 18 for cutting down, grading and macadamizing Woodward Hill. E. E. Pearson, co. audt.

New Brunswick, N. J.—Bids are asked until Sept. 2 for constructing stone roads. M. F. Larson, co. engr., Perth Amboy.

Noblesville, Ind.—Bids are asked until Sept. 10 for constructing 4 gravel roads. N. W. Cowgill, co. audt.

Canonsburg, Pa.—Sealed bids are asked until Sept. 6 for paving Jefferson and Bluff aves. J. M. Farmer, boro engr.

Valparaiso, Ind.—Bids are asked until Sept. 10 for grading, draining and paving Factory st. Chas. D. Jones, cy. clk.

Orange, N. J.—Bids are asked until Sept. 20 for constructing an 8-ft. concrete sidewalk in Main st. Com. coun.

Vernon, Ind.—Bids are asked until Sept. 6 for constructing 2½-mis. of pike road. F. L. Thomas, co. audt.

Knox, Ind.—Bids are asked until Sept. 6 for constructing 5-mis. of gravel roads. Lee M. Ransbottom, co. audt.

Greenwood, Miss.—Bids are asked until Sept. 7 for constructing 5-mis. of street paving. R. H. Hicks, cy. clk.

Terre Haute, Ind.—Bids are asked until Sept. 4 for grading and graveling several roads. N. G. Wallace, co. audt.

New York City—Bids are asked until Sept. 2 for resurfacing the old walks in Fort Green Park with asphalt. Park bd.

Oskaloosa, Kas.—Bids are asked until Sept. 18 for constructing the Kansas City-Olathe rock road and Thorpe road. Co. comrs.

Clinton, Tenn.—Bids are asked until Sept. 15 for constructing about 25-mis. of pike roads. J. K. P. Wallace, supt.

St. Paul, Minn.—Bids are asked until Sept. 7 for improving Larpenteur ave. by grading and paving. Edw. G. Krahmer, co. aud.

Harrisburg, Pa.—Bids are asked until Sept. 8 and 9 for building sections of the National road. Jos. W. Hunter, state highway comr.

Pensacola, Fla.—Bids are asked until Sept. 8 for constructing 2-mis. of vitrified brick paving on 2 county roads. Bd. co. comrs.

Bayonne, N. J.—Bids are asked until Sept. 7 for asphalt paving in several streets. Council.

Paris, Ill.—Bids are asked until Sept. 3 for paving S. Central ave. F. J. Trogdon, prest. bd. local impvts.

Silverton, O.—Bids are asked until Sept. 4 for constructing cement sidewalks in Montgomery pike. A. A. Sprague, vil. clk.

Lakewood, O.—Bids are asked until Sept. 8 for improving Ridgewood ave. B. M. Cook, vil. clk.

Superior, Wis.—Bids are asked until Sept. 2 for constructing cement sidewalks. Geo. E. Rolph, chmn. B. P. W.

Lancaster, O.—Bids are asked until Sept. 4 for constructing a cement sidewalk at Broad and Main sts. Geo. C. Cunningham, clk. B. P. S.

East Chicago, Ind.—Bids are asked until Sept. 6 for constructing cement sidewalks. Oscar P. Goerg, cy. clk.

Marion, Ia.—Bids are asked until Sept. 6 for constructing cement sidewalks. F. L. Anderson, mayor.

pie st. with asphalt on 5-in. concrete base

North Braddock, Pa.—Bids are asked until Sept. 3 for grading, paving and curbing 3 streets and 1 alley. C. E. Stewart, boro engr.

Fremont, O.—Bids are asked until Sept. 11 for improving 4-mis. of the Bonawit road by macadamizing. Co. comrs., Bowling Green, O.

New Haven, Conn.—Bids are asked until Sept. 3 for paving 3 streets with crushed stone and tar dressing; Congress st. with shale brick and wood blocks. Pub. com. on sts.

Cincinnati, O.—Bids are asked until Sept. 3 for paving McLean ave. with granite blocks, wood blocks, bitulithic or granitoid block pavement. J. A. Cline, clk. B. P. S.

Ft. Leavenworth, Kas.—Bids are asked until Sept. 7 for constructing roads, walks, driveways, gutters, curbs, etc. Capt. Wm. Davis, constr. Q. M.

Indianapolis, Ind.—Bids are asked until Sept. 3 for constructing a boulevard and parkway along the north bank of Fall Creek. Henry Jameson, prest. park bd.

Kennedy Heights, O.—Bids are asked until Sept. 11 for improving Fern and Ridgeway aves. by macadamizing and constructing artificial stone sidewalks. O. W. Bennett, vil. clk.

Guthrie, Okla.—Bids are asked until Sept. 2 for paving Spring ave. and Ma- and combined concrete curb and gutter. A. A. Leer, cy. clk.

Columbus, O.—Bids are asked until Sept. 4 for macadamizing Hess Pike. Walter Braun, co. surv.—Bids are asked until Sept. 10 for grading and graveling "Gay" road. F. M. Sayre, co. audt.

Fort Totten, N. Y.—Bids are asked until Sept. 10 for constructing 2,644-cu. yds. of excavation; 667-sq. yds. macadam roads; 5,000-sq. ft. of concrete walks; 665-ft. of drains. Constr. Q. M.

Vicksburg, Miss.—Sealed bids are asked until Sept. 6 for paving Cherry st. with asphalt, bitulithic, mineral rubber, granitoid, vitrified brick, and creosoted wooden blocks. C. R. Twiss, cy. enr.; J. J. Hayes, mayor.

Griffin, Ga.—Bids are asked until Sept. 8 for constructing 32,241-sq. yds. of brick, wood block, granitoid or bitulithic paving on concrete; 14,589-lin. ft. granite curbing; grading, etc. Hazelhurst & Anderson, engrs., Candler Bldg., Atlanta, Ga.

Hutchinson, Kas.—Sealed bids are asked until Sept. 8 for constructing 36,000-sq. yds. of brick, creosoted wood blocks, bitulithic, bituminous concrete or Portland cement concrete pavement, and 7,000-lin. ft. of curb and gutter. G. L. McLane, cy. engr.

White Plains, N. Y.—Bids are asked until Sept. 7 for repairing with brick the tracks of the Tarrytown, White Plains & Mamaroneck Ry. Co.; also, relaying the macadam between the tracks of the company in certain streets. Earl P. White, clk. bd. vil. trustee.

CONTRACTS AWARDED.

Burlington, Vt.—E. E. Moore was awarded the contract for curbing North ave.

Goldsboro, N. C.—Bigler Bros. secured the contract for paving the streets.

Marion, O.—Brady & O'Connell secured the contract for constructing the Everett pike, for $6,015.

Attica, Ind.—Elbert McKee was awarded a contract for constructing a gravel road for $7,267.

Bay City, Mich.—Van Poppelen & Munley were awarded a contract for paving Water st. for $15,540.

St. Joseph, Mo.—The contract for macadamizing Saxton road was awarded to J. P. Dunn, at $1.07 a lin. ft.

Kearney, N. J.—The contract for paving Elm st. was awarded to the Hassam Paving Co. for $17,412, Aug. 11.

Buffalo, N. Y.—The contract for asphalt repairs was awarded to the German Rock Asphalt & Cement Co.

Cincinnati, O.—The contract for paving Jefferson ave. was awarded to August J. Henkle, for $3,168.75.

Rockville, Ind.—Harvey Hawkins was awarded the contract for constructing Adams and Superior twps. road, for $3,994.

Wheeling, W. Va.—Coss & Meyer secured contracts for paving 19 streets and Geo. W. Lemmon contracts for 62 streets.

East Palestine, O.—The contract for paving W. Taggart and N. Market sts. was awarded to McLean & Armstrong, of Lisbon.

Richmond, Va.—J. E. Folkes submitted the lowest bid for constructing a macadamized road 3½-mis. in length, for $12,756.85.

Knoxville, Tenn.—The Barber Asphalt Paving Co. was awarded the contract for paving Temple ave. with asphalt.

East Liverpool, O.—Rinehart Bros. secured the contract for laying 4½-mis. of brick paving on concrete, for $92,000.

Birmingham, Ala.—The Graves-Matthews Contracting Co. was awarded the contract for paving 3rd ave. with brick, for $27,830.

Baltimore, Md.—The contract for constructing 5½-mis. of macadam road was awarded to McCormick & Co. at $10,000 per mi.

Jamestown, N. Y.—Warren Bros. Co., of Boston, secured the contract for paving E. 4th st. with bitulithic, for $26,412.75.

Rensselaer, N. Y.—Contracts for paving 2nd st. with Mack brick and Harrison ave. with granite was awarded, Aug. 19, to Wiltse & Rigney, for $15,817.52.

Florence, Colo.—The contract for constructing sidewalks and crossing in the new sidewalk district in W. 2nd st. was awarded to Wm. Tennant, for $1,000.

Marianna, Ark.—The contract for paving a number of blocks of streets with vitrified brick was awarded to W. H. Petty, of Pine Bluff, Aug. 9, for $32,000.

Milwaukee, Wis.—The contract for paving 12th st. with asphalt, between Cedar and Vliet sts., was awarded to the Badger Construction Co., at $2.34 a sq. yd.

Pine Bluff, Ark.—The contract for constructing concrete sidewalks in dist. No. 1, with combination concrete curb and gutter was awarded to Dunnington & Royce.

Philadelphia, Pa.—The contract for repaving Market st. with creosoted resin wooden blocks and Belgian blocks was awarded to Edwin H. Vare, for $287,862.18.

Chatham, Va.—J. T. Bennett has been awarded the contract for macadamizing about 4-mis. of road in this county, which was undertaken by Haymes Bros., and given up.

Buffalo, N. Y.—The Barber Asphalt Paving Co., 880 Ellicott Square, submitted the lowest bid for paving Elmwood Place, at $26,300 for tar macadam base, and $31,300 for concrete base.

Hamilton, O.—The Garver Construction & Transfer Co. was awarded the contract for paving the roadway of the High and Main st. bridge with creosoted wood blocks.

Atlanta, Ga.—The contract for paving Decatur st. and Madison ave. with creosoted wood blocks was awarded to Venable & McCandless, of this city, a $2.49 and $2.58 respectively.

Indianapolis, Ind.—The Union Asphalt Construction Co. was awarded the contractract for paving Kentucky ave., at $3.12 a lin. ft. for California asphalt and $3,500 for alley intersections.

Baltimore, Md.—The lowest bids submitted Aug. 18 for paving Auchentoroly Terrace and Mondawin ave. was that of the Filbert Paving & Construction Co., of Philadelphia, at $1.74 a sq. yd. for asphalt.

Fostoria, O.—Contracts for constructing stone roads have been awarded as follows: 1-mi. on McDougall, Tiffin and Perrysburg highways, $9,788.36; 1-mi. on Springville road, Stinchomb, Lee & Peter, $6,736.66.

Tacoma, Wash.—The Barber Asphalt Paving Co. was awarded the contract for paving Tacoma ave. with asphalt for $52,250, and R. S. Blome & Co., of Chicago, the contract for paving Court with granitoid, for $14,896.

Kansas City, Mo.—The Parker-Washington Co. has been awarded contracts for street paving with 10-yrs. maintenance clause, as follows: Virginia st., $2.05 a sq. yd.; Oakley st., $1.90; Charlotte st., $2.; Wabash st., $1.85.

Knoxville, Tenn.—The contract for cutting down the Blake Hill on the strawberry Plains road was awarded to J. T. Hickey & Son, for about $2,000; repairing Rutledge pike, Alex Blagotti, $1,500;

repairing Ruggles Ferry road, J. W. Gillespie.

Kansas City, Mo.—Contracts for grading roads have been awarded as follows: Sheley lane, W. R. Latimer, $3,128; road from Greenwood to Tennyson schoolhouse, Davidson Bros., $1,205; road from Greenwood 3-mls. east, Colyer Bros., $6,275.

Norwalk, O.—The Buckeye Engineering Co. has been awarded contracts for constructing 1-mi. of pike on the Wakeman-Clarksfield road for $5,300. George Stoll, of Wakeman, secured the contract for piking about 1-3-mi. of Birmingham road east, for $1,800.

Albany, N. Y.—Contracts for constructing state highways were awarded Aug. 6 as follows: repair contr. No. 1, Thos. Hucknell, Albion, $5,877.10; No. 2, Monroe Roads Co., Pittsford, N. Y., $16,870; No. 3, Casey & Murray, 311 Powers Bldg., Rochester, $17,900; No. 4, Monroe Roads Co., $19,182.50; No. 5, Monroe Roads Co., $17,363.60; No. 6, E. D. Baker, 27 Broome st., Binghamton, $11,808.54.

Washington, D. C.—Bids were submitted Aug. 18 for constructing cement sidewalks during the fiscal year, as follows: Cranford Paving Co., 98 cts. a sq. yd. for class A walks, which includes all large work within the city of Washington and along paved streets outside the city; class B, which includes all small jobs wherever located within the District, $1.18 a sq. yd.; R. J. Beall Constr. Co., $1.04½ for class A walks and $1.22½ for class walks; James W. Bean, $1 for class and $1.34 for class B.

Fowler, Ind.—Contracts for constructing stone roads have been awarded as follows: Romel stone road to Ed. Cyr, Jr., four miles in length, at $12,835; the Bower road, three miles, stone, to L. W. Book, at $16,087; Michael stone road, one mile, to L. L. Rook, at $3,300, and the Ballenselfer stone road, three miles, to Frank Ballenseifer, at $8,975.

Nashville, Tenn.—Contracts for constructing sidewalks have been awarded as follows: 15th ave., Uncle Hiram Roofing Co., at $1.49 per sq. yd.; Ewing ave., Nashville Roofing & Paving Co., at $1.46½ per sq. yd.; Grand ave., J. T. Southgate, at $1.46½ per sq. yd.; Eleventh ave., Southern Roofing & Paving Co., at $1.49 per sq. yd.; sidewalks and curbing on Monroe st., to same company, all of Nashville.

New York City.—Bids were submitted Aug. 12 for regulating, grading, setting curbs, flagging sidewalks, laying crosswalks, etc., in 230th st., as follows: F. V. Smith constructing Co., 147 E. 125th st., $110,110; L. C. Rodgers, Jr., Baychester, $87,259; C. W. Collins, 91 E. Fordham road, $82,785; McDonald & Barry, Tiebout ave. and 183rd st., $74,897; D. W. Moran, 562 Burnside ave., $79,406; J. B. Malatesta, 3160 Jerome ave., $76,962; Haggerty Contracting Co., 2459 Davidson ave., $98,596.

Norfolk, Va.—Contracts were awarded Aug. 2 for paving streets with some smooth material as follows: Colonial ave., bitulithic surface, to Atlantic Bitulithic Co., at $28,519; Holt st., asphalt block, to Washington Asphalt Block & Tile Co., at $16,870; Botetourt st., wood surface, to U. S. Wood Preserving Co., 29 Broadway, New York, at $6,110; Redgate ave., asphalt block, Washington Asphalt Block & Tile Co., at $12,720; Twelfth st., wood surface, U. S. Wood Preserving Co., at $28,354; Mowbray Arch East, to same, at $2,000; Mowbray Arch West, to same, at $107,083.

Albany, N. Y.—Contracts for constructing state highways have been awarded as follows: Little Falls-Dolgeville road, Newport Construction Co., of Newport, for $5,532.50; Plattsburg-Keesville road, to Spellman & Oliver Co., of Clayton, for $35,582; contract No. 14 in Waterford, to Barber Asphalt Paving Co., of Corner's road, Rensselaer county, to J. W. Ryan, Waterford; Glens Falls-Saratoga road, Saratoga county, to Naylor & Fox, Saratoga, for $13,810.80.

St. Louis, Mo.—Contracts for improving 22 streets were awarded, Aug. 10, at a total cost of $300,000, as follows:

Brick—Potomac, Louisiana to California, Wm. R. Bush Construction Company, $24,184.76; Penrose, from Newstead 670 feet west, Strainka Construction Company, $5,963.88; Doddridge, Lowell to Broadway, Fruin-Colnon Contracting Company, $4,232.95; Juniata, Morgan Ford road to Alfred, Webb-Kunze Construction Company, $3,960.42; Lismore, Sullivan to Hebert, James T. McMahon, $2,930.72; Iowa, Winnebago to Miami, Wm. R. Bush Construction Company, $5,058.26; Wells, Clara to Hodiamont, Webb-Kunze Construction Company, $27,838.20; Horton, Hodiamont to western city limits, Fruin-Colnon Contracting Company, $2,837.55; Maple, Hodiamont to western city limits, James T. McMahon, $2,058.32; Etzel, Hodiamont to western city limits, Fruin-Colnon Contracting Company, $3,560.41; Baden, from 782 feet east of Broadway to waterworks conduit, Fruin-Colnon Contracting Company, $6,186.94; Oregon, Itaska to Neosho, Wm. R. Bush Construction Company, $4,423.89; Potomac, Grand to Gustine, Wm. R. Bush Construction Company, $16,507.41; Warne, Kossuth to Lee, James T. McMahon, $3,364.62; Jefferson, Chippewa to Gravois, Wm. R. Bush Construction Company, $59,736.72; Fifteenth, from Cass to Nineteenth and Wright, Wm. R. Bush Construction Company, $25,417.87; Nineteenth, from St. Louis to Branch, James T. McMahon, $13,850.99; Robbins lane, from St. Charles to Washington, same, $1,100.35. Telford—McCausland, Manchester to Clayton, Webb-Kunze Construction Company, $34,489.15; Blendon, Bruno to Stanley, same, $5,860.60. Wood Blocks—Olive, from Fourth to Twelfth, Granite Bituminous Paving Company, $13,899, less $3,647.70 for old granite blocks. Granite—Jefferson, from Cass to St. Louis, G. Eyermann & Bro., $23,068.60. The estimated cost of this work was $600,000.

SEWERS.

New York City—Hady, Wright & Osgood have been incorporated to erect and install the Ashley system of sewage purifications and disposal plants, by Samuel B. Hady, 941 Simpson st., N. Y. City; Bayard Wright, Haworth, N. J.; Dwight E. Osgood, 215 106th st., N. Y. City.

CONTEMPLATED WORK.

Indianapolis, Ind.—Plans are being prepared for a sewer in Parkway ave.

Pratt City, Ala.—Voted to issue $45,000 bonds for sewer construction.

Bettendorf, Ia.—Voted to issue bonds for constructing a sewerage system.

Herington, Kas.—Will vote on the question of constructing a sewerage system.

Magnolia, Miss.—The extension of the sewerage system is contemplated.

Council Bluffs, Ia.—The construction of a large sewerage system is contemplated.

Mena, Ark.—A sewerage and waterworks system will be installed here by H. W. Cardwell.

Snyder, Tex.—A petition is being circulated asking for a sewerage and waterworks system.

Fulton, Ky.—This city is talking of issuing bonds for completing the sewerage system.

San Antonio, Tex.—Voted to issue bonds for constructing a sewerage system in Beacon Hill.

Hamilton, Ont.—The estimated cost of constructing a new sewer in the West End is $27,513.

Sloan, N. Y.—The installation of a sewage disposal plant is being discussed by this village.

Belle Plaine, Ia.—The city council decided, Aug. 20, to construct an adequate sewerage system.

San Antonio, Tex.—The Beacon Hill district voted to issue $20,000 bonds for building sewers.

Royersford, Pa.—The question of constructing a sewerage system and filtration plant is being agitated.

Garnett, Kas.—Plans are being prepared for a sewerage system. Septic tanks will also be constructed.

Fitchburg, Mass.—Will vote Sept. 18 on the issue of $75,000 bonds for constructing a sewerage system.

Carthage, O.—Will vote Sept. 21 on the question of issuing $70,000 bonds for constructing a sewerage system.

Tucumcari, N. Mex.—W. P. Bullock has been engaged to make surveys and estimates for installing a sewerage system.

Freehold, N. J.—An extension of the sewerage system is contemplated for this fall, including 3 new pumping stations.

Hamilton, O.—A resolution has been passed for constructing a sanitary storm sewer in various streets in the 3rd ward.

Kansas City, Kas.—An ordinance has been passed creating the Brighton Hill sub-sewer district. J. E. Smyth, cy. clk.

Evansville, Ind.—The residents of Law ave. are circulating a petition asking for the construction of a sewer in that street.

Houston, Tex.—Plans and specifications have been submitted for sanitary sewers in the 1st and 6th wards. H. B. Rice, mayor.

Little Rock, Ark.—The city council of Pulaski Heights has about decided to construct a septic tank. T. J. Jackson, mayor.

Warren, O.—B. C. Smith, cy. engr., has prepared plans for a sewerage system in northwest Warren, requiring 4-mis. of sewers.

Sandpoint, Idaho.—Prof. Ogden, of Ithaca, N. Y., has been engaged to superintend the construction of a sewerage system here.

New Decatur, Ala.—An ordinance has been passed providing $18,000 for the construction of a sewerage system. W. A. Calla, cy. engr.

St. Louis, Mo.—Plans will be prepared for constructing a reinforced concrete sewerage system. J. A. Hooke, engr. bd. local impvts.

St. Augustine, Fla.—Preliminary surveys preparatory to constructing a sewerage system will be made by W. W. Lyon, C. E., of Jacksonville.

Chester, Pa.—Plans for an improved sewerage system to conform with the state law will be made by Alexander Potter, C. E., of New York City.

St. Cloud, Minn.—The city engineer has been authorized to prepare plans and specifications for a sewer district in the western and southern parts of this city.

Washington, N. J.—This city has voted to install a sewage disposal plant to remove one source of pollution of the Delaware river, from which this city obtains its drinking water.

Grand Rapids, Wis.—The sewer committee and the city engineer have been directed to investigate the most feasible plan of sewerage for Grand ave. and 17th st.

Huntsville, Tex.—(Special). H. G. Eastham, mayor, says this city is about to construct a sewerage system and he desires to communicate with parties interested in such work.

Cincinnati, O.—The question of improving the Millcreek valley by constructing a system of sewers is being renewed by the business organizations in the valley from Wyoming to Lockland.

Trenton, N. J.—A report has been submitted to the common council by John O. Gretton, chmn. sewage disposal comn. on a sewage disposal plant for this city. He estimates the total cost to equip the plant at $600,000, and about $15,000 a year for maintenance.

CONTRACTS TO BE LET.

Marshall, Minn.—Bids are asked until Sept. 6 for constructing 10 catch basins. C. P. Shepard, cy. recdr.

Sioux Falls, S. D.—Bids are asked until Sept. 8 for constructing ditch No. 3. Henry Howe, co. audt.

Fergus Falls, Minn.—Bids are asked until Sept. 2 for constructing ditch No. 42. Wm. Lincoln, co. audt.

Wheaton, Minn.—Bids are asked until Sept. 11 for constructing judicial ditch No. 3. J. T. Erickson, co. audt.

Greenwood, Miss.—Bids are asked until Sept. 7 for constructing a 3-mi. drainage ditch. Gid Montjoy, mayor.

Estherville, Ia.—Bids are asked until Sept. 16 for constructing county drain No. 47. Roy J. Ridley, co. audt.

Alliance, O.—Bids are asked until Sept. 3 for constructing a sanitary sewer. C. E. Swearingen, clk. B. P. S.

Vicksburg, Miss.—Sealed bids are asked until Sept. 6 for constructing a storm sewer in Cherry st. J. J. Hayes, mayor.

Girard, O.—Bids are asked until Sept. 3 for constructing sewers and house connections. J. F. McFarlin, vil. clk.

Irvington, N. J.—Bids are asked until Sept. 7 for constructing sewers in several streets. Geo. M. Wills, chmn. town coun.

St. Paul, Minn.—Bids are asked until Sept. 7 for constructing judicial ditch No. 1. Geo. A. Ralph, state drainage engr.

Aitkin, Minn.—Bids are asked until Sept. 21 for establishing a public ditch in the towns of Aitkin and Morrison. Co. bd.

Charleston, S. C.—Bids are asked until Sept. 7 for constructing terra cotta pipe of various sizes. J. H. Dingle, cy. engr.

Cherokee, Ia. Bids are asked until Sept. 7 for constructing about 20,000-ft. of 6, 8 and 10?in. vitrified pipe sewer. Cy. clk.

Linton, Ind.—Bids are asked until Sept. 8 for constructing a sewer for the Main school building. John J. Fritz, prest. school bd.

Philipsburg, Pa.—Bids are asked until Sept. 7 for constructing 4,100-ft. of sewer on pile and timber foundation. Geo. H. Ayres, boro. engr.

Columbus, O.—Bids are asked until Sept. 7 for constructing the Mason run ditch in Truro and Mifflin twps. Walter Braun, co. surv.

Connelsville, Pa.—Bids are asked until Sept. 7 for constructing 3,829.8 lin. ft. of vitrified pipe sewers in the South Side. A. O. Bixler, clk.

Fort Morgan, Ala.—Bids are asked until Sept. 20 for constructing terra cotta pipe sewers and iron outfall pipe here. Capt. H. B. Chamberlain, Q. M.

Iowa Falls, Ia.—Bids are asked until